Senior Secondary Course

ECONOMICS (318)

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NIOS SENIOR SECONDARY - ECONOMICS (318)

Complete Textbook (29 Lessons)

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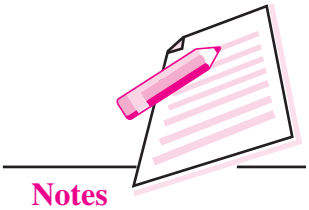

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OVERVIEW OF INDIAN ECONOMY

Every economy in the world has its own characteristics or features by which it is known or identified. Economies are compared with each other on the basis of these features. India as a distinct nation came into existence on 15th August 1947, called the independence day of India which marked the end of British rule over India. After that, Independent India has completed 66 years of self rule on 15th August 2013. This period is long enough to evaluate the position and performance of the country to enable comparison with other countries in the world as well as evaluate its own progress over the years. With this view in mind the current lesson provides the features of Indian economy.

OBJECTIVES

After completing this lesson, you will be able to:

- describe the characteristics or features of Indian economy;
- explain the problems faced by Indian economy;
- explain the role of agriculture in India; and
- describe the growth of industry in India.

1.1 FEATURES OF INDIAN ECONOMY

Let us now list the features of Indian economy as follows:

(i) Low per capita income

(ii) Heavy population pressure

(iii) Dependence of population on agriculture

(iv) Poverty and Inequality income distribution

(v) Higher level of capital formation which is a positive feature

(vi) Planned economy

let us discuss these points one by one.

(i) Low per capita income

India is known in the world as a country with low per capita income. Per capita income is defined as the ratio of national income over population. It gives the idea about the average earning of an Indian citizen in a year, even though this may not reflect the actual earning of each individual. India's per capita income for the year 2012-2013 is estimated at ₹ 39,168. This comes to about ₹ 3,264 per month. If we compare India's per capita income with other countries of the world then it can be seen that India is well behind many of them. For example, the per capita income of USA is 15 times more that of India while China's per capita income is more than three times of India.

(ii) Heavy population pressure

India is world's second largest populated country after China. As per 2011 census India's population stands at more than 121 crores. It increased at a rate of 1.03 percent during 1990-2001. The main cause of fast rise in India's population is the sharp decline in death rate while the birth rate has not decreased as fast. Death rate is defined as the number of people died per thousand of population while birth rate is defined as the number of people taking birth per thousand of population.

In 2010, the birth rate was 22.1 persons per one thousand population while the death rate was only 7.2 persons per one thousand population. Low death rate is not a problem. In fact it is a sign of development. Low death rate reflects better public health system. But high birth rate is a problem because it directly pushes the growth of population. After 1921, India's population increased very fast because birth rate declined very slowly while death rate declined very fast. From 49 in 1921 the birth rate declined to 22.1 in 2010 while during the same time period, death rate declined from 49 to 7.2. Hence the population growth was very rapid in India.

Heavy population pressure has become a major source of worry for India. It has put burden on the public exchequer to mobilize enough resources to provide public education, health care, infrastructure etc.

(iii) Dependence on Agriculture

Majority of India's working population depend on agricultural activities to pursue their livelihood. In 2011 about 58 percent of India's working population was

engaged in agriculture. In spite of this, the contribution of agriculture to India's gross domestic product is a little over 17 percent. A major concern of agriculture in India is that productivity in this sector is very less. There are many reasons for this. There is heavy population pressure on land to sustain huge number. Due to population pressure on land the per capita availability of land area is very low and not viable for extracting higher output. Two, since per capita land availability is less, a majority of people are forced to become agricultural labour working at low wages. Three, Indian agriculture suffers from lack of better technology and irrigation facilities. Four, mostly people, who are not educated or not trained properly, are engaged in agriculture. So it adds to low productivity in agriculture.

INTEXT QUESTIONS 1.1

Fill in the blanks

1. India's per capita income is ..... of that of China?
   (a) twice (b) one third
   (c) same as (d) none of the above
2. USA's per capita income is ..... of that of India?
   (a) 15 times (b) 10 times
   (c) less than (d) none of the above
3. As per 2011 census, India's population stands at
   (a) more than 100 crore (b) less than 100 crores
   (c) more than 121 crores (d) none of the above
4. India's Birth rate in 2010 was:
   (a) 20.2 (b) 21.2
   (c) 22.1 (d) 23.2
5. India's death rate in 2010 was
   (a) 7.2 (b) 7.4
   (c) 7.8 (d) 7.9
6. India's population growth was rapid because
   (a) death rate is more than birth rate
   (b) birth rate is more than death rate
   (c) birth rate is same as death rate
   (d) none of the above

7. In 2011, ... percent of India's working population was engaged in agriculture?

   (a) 70 (b) 80

   (c) 68 (d) 58

8. Contribution of agriculture to India's national income in 2011 was around

   (a) 10 percent (b) 20 percent

   (c) 17 percent (d) 25 percent

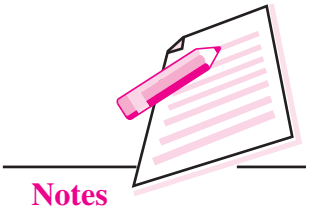
(iv) Poverty and inequality

Another very disheartening thing about India is that it has world's largest number of poor people. As per reports of government of India, in 2011-12 about 269.3 million people in India were poor. This was about 22 percent of India's population. A person is termed poor if he/she is not able to consume the required amount of food to get a minimum calorie value of 2400 in rural area and 2100 in urban area. For this the person must earn the required amount of money as well to buy the food items. The government has also estimated that the required amount of money is ₹ 816 in rural area and ₹ 1000 in urban area per head per month. This comes to about ₹ 28 in rural area and ₹ 33 in urban area per head per day. This is called poverty line. This implies that 269.9 million people of India were not able to earn such little amount in 2011-12.

Poverty goes with inequality in income and wealth distribution. Very few in India posses materials and wealth while majority have control over no or very little wealth in terms of land holding, house, fixed deposits, shares of companies, savings etc. Only top 5 percent of households control about 38 percent of total wealth in India while the bottom 60 percent of household has control over only 13 percent of the wealth. This indicates concentration of economic power in a very few hand.

Another issue linked to poverty is the problem of unemployment. One of the most important reasons of poverty in India is that there is lack of job opportunities for all the persons who are in the labour force of the country. Labour force comprises of the adult persons who are willing to work. If adequate number of jobs are not created every year, the problem of unemployment will grow. In India every year large number of people are added to the labour force due to increase in population, increase in number of educated people, lack of expansion of industrial and service sector at the required speed etc.

So far we discussed the negative features. There are certain positive features of Indian economy as well. They are discussed below.



(v) Higher rate of capital formation or investment

At the time of independence, one of the major problem of Indian economy was deficiency in capital stock in the form of land and building, machinery and equipment, saving etc. In order to continue the cycle of economic activities such as production and consumption, a certain ratio of production must go towards saving and investment. However, the required ratio was never generated in the first four to five decades after independence. The simple reason being higher consumption of necessary items by the population of whom most happened to be poor and lower middle income class. Collective household saving was very less due to this. Consumption of durable items was also very less. But in recent years things have charged. Economists have calculated that in order to support the growing population, India requires 14 percent of its GDP to be invested. It is encouraging to note that the saving rate of India for the year 2011 stands at 31.7 percent. The ratio of gross capital formation was 36.6 percent. This is possible because people are now able to save in banks, consume durable goods and there has been large scale investment taking place on public utilities and infrastructure.

(vi) Planned economy

India is a planned economy. Its development process has been continuing through five year plan since the first plan period during 1951-56. The advantage of planning is very well known. Through planning the country sets its priorities first and provides the financial estimates to achieve the same. Accordingly efforts are made to mobilise resources from various sources at least cost. India has already completed eleven five year plan periods and the twelfth plan is in progress. After every plan a review is made analysing the achievements and short falls. Accordingly, things are rectified in the next plan. Today India is a growing economy and recognised every where as a future economic power. The per capita income of India is growing at a higher rate than before. India is seen as a big market for various products. All these are possible due to planning in India.

1.2 ROLE OF AGRICULTURE IN INDIA

Agriculture is one of the most important sectors of Indian economy. It is the supplier of food and raw materials in the country. At the time of independence more than 70 per cent of India's population depended on agriculture to earn livelihood. Accordingly the share of agriculture in the national product/income was as high as 56.6 per cent in 1950-51. However with development of industries and service sector during the plan periods, the percentage of population depending on agriculture as well as the share of agriculture in the national product has come down. In 1960, the percentage of labour force engaged in agricultural activities was 74 which gradually came down over the years to 51 per cent in 2012. In 1960 the share of labour force in industry and service sectors stood at 11 and 15 percent

respectively. But in 2012 these shares increased to 22.4 and 26.5 percent respectively. It has been observed in most of the economies that along with economic development shift in labour force from agriculture to industry and service sector takes place.

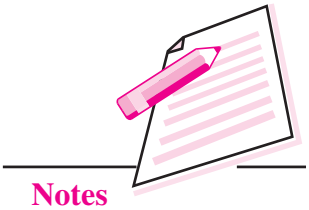
Agriculture is the source of food supply. The production of food grains has increased from nearly 55 million tonnes in 1950-51 to 259 million tones in 2012-13. Because of the growth in food grain production, India's dependence on import of food grains has declined and almost become nil. Keeping in view the rapid growth in India's population, increase in food grain was a necessity which the country achieved significantly. Except for pulses, increase in food grains has been mode possible by increase in cereals and various cash crops.

Agriculture is also a major source of foreign exchange earning through export. The share of agriculture in India's export in the year 2011-12 was 12.3 percent. The major items of export include tea, sugar, tobacco, spices, cotton, rice, fruits and vegetables etc.

1.3 GROWTH OF INDUSTRY IN INDIA

Industry or the secondary sector of the economy is another important area of economic activity. After independence, the government of India emphasized the role of industrialization in the country's economic development in the long run. Accordingly, the blue print for industrial development was made through the Industrial Policy Resolution (IPR) in 1956. The 1956 policy emphasized on establishment of heavy industries with public sector taking the lead in this area. Adoption of heavy or basic industries strategy was justified on the ground that it will reduce the burden on agriculture, enable growth in the production of consumer goods industries as well as small industries that are helpful for employment generation and achieving self reliance. After the adoption of the IPR, 1956 there was tremendous growth in industrialization during the second and third plan periods i.e. 1956-61 and 1961-66. Public sector contributed maximum to this growth. But towards the end of 1960s, investment in industries was reduced which adversely affected its growth rate. In the 1980s, this trend was reversed and investment in industries was increased by making the infrastructure base such as power, coal, rail much stronger.

In early 1990s it was found that the public sector undertakings were not performing upto expectation. There has been reports of mismanagement in these under takings resulting in loss. So in 1991 the government of Indian decided to encourage the role of private sector in industrial development, remove the rigid licence system which is known as liberalization and allow international players to compete in the domestic country as well as domestic players to explore foreign territories. The aim of taking all these steps was to strengthen the process of



industrialization in the country. Such a model of industrial development is called Liberalization, Privatization and Globalization (LPG) model.

After the adoption of this new policy in 1991, there has been phases of growth followed by slowdown in the industrial development process. In the early years of 1990s there was significant growth in industrialization due to increase in investment in infrastructure, reduction in excise duty, availability of finance etc. But towards the end of 1990s the growth rate slowed down due to stiff competition from international companies, inadequate infrastructure support etc. However, in the beginning of the new millennium, between 2002-08 there was again some recovery due to increase in saving rate from 23.5 percent in 2001-2 to 37.4 percent in 2007-08. Even the competition from the foreign companies helped during this phase as the domestic companies could create enough internal strength in term of quality control, finance and customer care etc. to withstand the competition. However after 2008-09 there was some slow down in industrial growth due to rise in petroleum price, interest rate and borrowings from abroad which has created lot of liabilities for the domestic companies.

INTEXT QUESTIONS 1.2

1. What was share of agriculture in India's national income in 1950-51?
2. With economic development, labour force tend to shift from industry to agriculture. True or False
3. What was the share of agriculture in India's export in 2011-12?
4. Give the full form of LPG?
5. The industrial policy of 1956 emphasized on the strategy of
   (a) Light industries (b) small and medium industries
   (c) Heavy industries (d) none of the above

WHAT HAVE YOU LEARNT

In this lesson you have learnt that

- India is a developing economy with the promise to grow in future.
- India is currently among those countries whose per capita income is low.
- India is suffering from heavy population pressure
- A majority of india's populaiton is dependent on agriculture.
- There is high absolute poverty in India

- The gap between rich and poor is substantial in India
- Some positive features of Indian economy are
  - India's saving rate is high
  - Five year plannning in India is running successfully

TERMINAL EXERCISE

Short Answer Type Questions

1. Give one positive and two negative features of Indian Economy.
2. Give two reasons for low productivity in agriculture in India.
3. What is main cause of increase in population in India?
4. Why is India called planned economy?
5. Define poverty line in rural area.

Long Answer Type Questions

1. India suffers from heavy population pressure. Explain.
2. Explain two positive features of Indian economy.
3. India's per capita income is low? Do you agree. Give reasons.
4. Describe India as agricultural country.
5. Briefly discuss the poverty and inequality situation in India.
6. Explain the role of agriculture in Indian economy.
7. Explain the growth of industrialization in India?

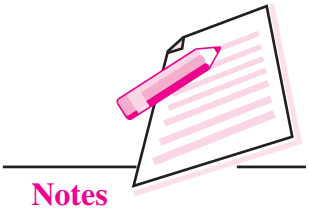
ANSWERS TO INTEXT QUESTIONS

1.1

1. (b) 2. (a) 3. (c) 4. (c) 5. (a) 6. (b) 7. (d) 8. (c)

1.2

1. 56.5 percent
2. False
3. 12.3 percent
4. Liberalization, Privatization and Globalization
5. Heavy industries



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ECONOMIC PLANNING IN INDIA

India is a vast country with multiple problems faced by its population. The British ruled the country for nearly two centuries and exploited its resources for their benefit leaving the country reeling under absolute poverty. When the British left India in 1947 there was nothing to be proud of or be happy except for the 'freedom'. The problems were many before the Indian government. Besides mass poverty there was the problem of food shortage and inflation. Illiteracy, lack of health care, lack of infrastructure etc. were other serious problems facing the country. As a long term strategy. 'Planning' for economic development was the answer to solve these problems.

OBJECTIVES

After completing this lesson, you will be able to:

- define "Planning";
- explain the need for planning;
- list out the objectives of planning;
- describe the strategy of planning in India;
- explain new economic policy;
- point out the targets set by our planners in terms of various objectives of planning;
- explain the achievements made with respect to the plan objectives; and
- realise the short comings or unfulfilled part of the objectives.

2.1 MEANING OF ECONOMIC PLANNING

Economic planning is a process which involves the following steps:

(i) Preparing a list of the problems facing the economy .

(ii) Rearranging the list on the basis of priority. The top priority issue which needs to be addressed immediately should be placed at number one and so on.

(iii) The next step is to identify the problems which are to be solved in the immediate short run and the other problems which are to be addressed over the long period.

(iv) Fixing a target to achieve the desired goal. The target could be a specified time period within which the problem must be solved. If the problem is to be addressed over long run, then it must be made clear that how much of the problem be solved in the first period (say a year or six months) and so on. Secondly the target could be a certain quantity to be achieved. Say in case of production, the government can fix some target in terms of quantity.

(v) Estimating the amount of resources needed for achieving the target. Resources include financial resource, human resource, physical resource etc.

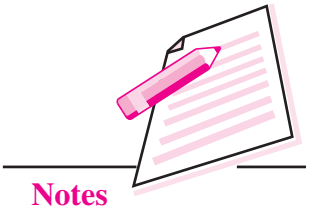
(vi) Mobilizing the resources is another important task. This means that the planners must know the sources of arranging the required resources. For example, in case of financing the plan, the planners must make the budget and spell out the different sources of finding. When the government makes plan, one of its major source of getting funds in the tax revenue. For a business person, one of the sources of finance is the loan from bank. When various sources of funds are available then the planner must also decide as to how much fund to be collected from each of these sources.

Use of the human resource is another important task to execute the plan proposal. The planner must estimate the type of man power and the number of persons required to carry out the task. A proper estimate on this requirement should be given at the outset. Similarly proper estimate of physical resources should also be provided. Physical resources include office buildings, vehicles, furniture, stationeries etc.

(vii) Once the resources are arranged, implementation and execution process starts in an organize manner to achieve the desired goal. To make sure that everything is running smoothly and to rectify mistakes if any or to modify the style of working to accommodate any change, periodic review must be done till the final achievement is realised.

2.2 ECONOMIC PLANNING IN INDIA

India adopted a system of five yearly planning to address its various socio-economic problems. You have already been told about the problems of Indian



economy at the time of its independence. To remind, these problems include mass poverty and inequality, low productivity in agriculture and storage of food grains, lack of industrial and infrastructural development etc. Since these are to be solved over the long period, Indian government adopted five year plan starting from first year plan in 1951 development. The idea was to make a list of important problems to be solved keeping in view the given resources and the capacity to arrange the resources. Then make a review after five years of what has been done and rectify the mistakes accordingly in the next five year plan period and so on.

Some of the great architects of Indian planning include Jawaharlal Nehru, P.C Mahalonobis, V.R Gadgil, V.K.R.V Rao. After becoming the first prime minister of independent India, Nehru established the Planning Commission in 1950. The major function of the Planning Commission was to formulate plans keeping in view the resources of the country and suggesting the best methods to utilize them effectively and in a balanced manner. Planning commission prepared the first five year plan (FYP) for the period 1951-1956. By 2014, India has already experienced more than sixty years of planning with eleventh five year plans being completed are twelfth FYP continuing.

2.3 OBJECTIVES OF PLANNING IN INDIA

The various objectives of economic planning in India are drawn keeping in view its socio-economic problems. Accordingly the objectives as follows:

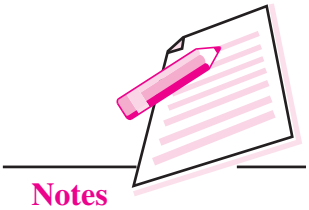
1. Economic growth
2. Increase in employment
3. Reduction in inequality of income
4. Reduction in poverty
5. Modernization of the economy
6. Ensuring social justice and equality.

Let us discuss these objectives one by one .

1. **Economic Growth :** The objective of achieving economic growth implies that the real national income and per capita income must grow every year at a targeted rate. Real national income is the measure of national income at a given years price or at a constant price. Real per capita income is the average income of individuals in the economy. It is argued that in order to achieve higher standard of living for each individual /household and the society as a whole , both per capita income and national income must grow in real terms. Since income represents purchasing power, increase in income will enhance the purchasing power of people and the country. When purchasing power will

increase then individuals can buy more goods and services to satisfy their wants. The country as a whole can pay for its purchases from abroad called import. Increase in real income also means that the output level or quantity of output is higher than before. Here output includes output in different sectors of the economy such as agricultural output, industrial output and services to satisfy the needs of India's growing population increase in output every year has to be achieved. To achieve higher rate of output the economy must increase its rate of investment to create infrastructure and capital stock. Infrastructure includes power projects, roads, railways, airports, ports, telecommunication network, buildings etc. Capital stock includes plant, machinery, banking and insurance etc. Investment in all these things is necessary to achieve economic growth in real income, hence the planners of the country set a target for growth in each five year plan keeping in view the growth of population and demand for goods and services etc.

2. **Increase in Employment:** Employment refers to engagement of the labour force in gainful economic activity such as production of goods and services. Income is generated through the production process where the production process involves employment of factors of production provided by the households. You know that factors of production include land, labour, capital and organization/entrepreneurship. These factors are owned by the households of the country. As factors are scarce resources and needed to produce goods and services, it is important for the government to create opportunities where in they can be properly used/utilized. The production capacity of an economy depends on the amount of the factor resources it possesses. The required amount of output can be generated if these factors of production get employment. The value of the output then can be distributed among the factors as their income in the form of wage for labour, rent to the owner of land and building, interest to the owner of capital and profit to the entrepreneur. If the country is not able to create employment opportunities to gainfully engage the factors of production, the required amount of output can not be produced and hence income can not be generated. Take the example of labour resources in the country. You know that the population of the country supplies labour force who are in the age group of 15 to 59 years. Every year due to increase in population the number of people in the labour force is also increasing. Most of them are also educated. If there is no enough scope to get employment then they will remain unemployed and unutilized. Infact the unemployment situation in India is very bad. Besides causing increase in consumption without corresponding increase in production, unemployment also is a cause of various social problems such as poverty and crime etc. So planners of the Indian economy put creation of employment as a major objective of five year plans.



INTEXT QUESTIONS 2.1

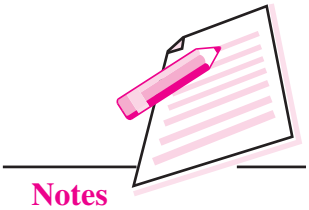
1. Economic growth means
   (a) Increase in real national income
   (b) Removal of inequality
   (c) Increase in price level
   (d) None of the above
2. National income can be increased by
   (a) Increase in population
   (b) Increase in the rate of investment
   (c) Increase in unemployment
   (d) Decrease in price level
3. Who are the owner of factors of production
   (a) Government
   (b) Rest of the world
   (c) Households
   (d) Firms and industries
4. Labour force comes from the population in the age group of
   (a) 4 to 14
   (b) 60 to 75
   (c) 10 to 15
   (d) 15 to 59

3. Reduction in Inequality of Income : India is a country with diverse economic standard of its population. This means that in terms of income level, India lacks uniformity. A large section of India's population belong to lower income group and termed as poor where as a few are very rich with very high level of income. Income disparity is a major concern of the social angle, women are the worst affected in terms of income standard irrespective of their caste or religion. Similarly the scheduled caste and scheduled tribe population belong to the marginalized section of Indian society as they are at the bottom of the pyramid of development. One of the major reasons of inequality in income is the unequal distribution of asset holding such as per capita land holding, possession movable and immovable property from inheritance etc. A majority of India's population live in rural area and work in agriculture. But a few are big land lords and majority are marginal or small farmers and agricultural labourers. Agricultural labourers are so called because they do not have their own land

to cultivate and move from one place to another in search of job on a daily or weekly wage basis. Their situation in worse because of their own illiterary and lack of scope to organize themselves. One to their low income they do not have anything to begin to their reset generation on the otherhand landlords enjoy higher returns to their property and due to existence of law of inheritance the property remains with their future generations. Hence, rich remains rich and poor remains poor in the country due to possession and lack of private property respectively. India is badly affected due to this inequality . The poor people are not able to support the market due to lack of purchasing power where too much purchasing power with the rich has caused wasteful consumption to increase. Most of the social evils are created due to inequality. Hence, our planners aimed at reducing the inequality in income distribution through planning.

4. **Reduction in Poverty :** Another major objective of planning in India is "reduction In poverty". At the time of independence more than fifty percent of India's population was poor. By the year 2014, nearly 27 to 28 percent of India's population is under poverty as per governments estimates. You will come to know about the manner in which poverty is estimated in India in the lesson on poverty and employment. For the time being let us confine our notion of poverty to the situation where in an individual is unable to satisfy his/her basic minimum needs of life. There are lot of people in the country who are not even getting a square meal a day. Lack of employment is a major cause of poverty . It is aggarated by unequal distribution of national wealth and income. Poverty is termed as a curse on human dignity and it has seriously tarnished the image of India in the world. Developed countries do not count India seriously due to its inability to remove poverty. It is proper planning to remove poverty completely from the country.

5. **Modernisation of the Economy :** India has been a country of continuous exploitation by foreign powers such as the Mughals who ruled for more than two hundred years and the British who also ruled the country for another two hundred years. The British in particular, left the country in dine poverty and underdevelopment when they handed over power to Indian government in 1947. Because of the historical reasons Indian economy could not rise from its traditional level of functioning. It remained an agrarian economy and industrially backward. There was no development in now technology and technological upgradation. Lack of modern technology is a major reason for Indian economy to suffer from low productivity in agriculture and lack of industrial development. At the time of independence and for many more years after that, the major contributor to India's GDP because of underdeveloped industrial and service sector. Combined with his lack of better education and skill development of the population, the occupational structure has also remained biased towards agriculture. Hence, to reverse such trend it is necessary to change the structure



of GDP of India by improving the quality of human resources and developing industries and service sector. This can be done by modernization of the economy.

6. **Ensuring Social Justice and Equility :** Indian planning also aimed at achieving a socialistic pattern of society. It can be achieved by ensuring its population social justice and equity. In fact all the objectives said above are necessary to achieve social justice. But the sufficient condition for sustaining social justice and equitable distribution of income is to introduce reforms in various sectors by changing the age old systems which have perpetuated poverty and inequality and obstructed development of industrial and service sector or caused low productivity in agriculture. So the planners thought to introduce reforms in agriculture and economic policy so that they facilitate growth and equitable distribution of the benefits of development.

INTEXT QUESTIONS 2.2

1. One of the reasons of inequality in income is
   a. Existence of private property
   b. Lack of equal distribution of wealth
   c. Both of the above
   d. None of the above
2. Which of the following sector used to have larger share in India's GDP at the time of its independence
   a. Industry
   b. Agriculture
   c. Service
   d. None of the above

2.4 NEED FOR PLANNING

A major part of the question about need for planning has been answered in the meaning of planning itself described above. There we said that planning involves various steps for effective implementation and execution. Infact the number of problems facing Indian economy is very high. Each problem is complex in nature and cannot be solved in a short period. Take the example of the problem of poverty. There is no method by which this problems can be solved immediately. The government must collect data to know the number of people affected by poverty and its nature. Collection of data itself is a very huge task keeping in view India's vast geographical area and lack of accessibility to many areas. In a democracy , the government is duty bound to formulate policies after proper debate and discussions which takes time. Then mobilization of adequate resources and provision of

resources to continue the programme over a long period are two most important things to solve the problem of poverty. Without proper planning it cannot be done. Planning is also necessary to avoid wasteful expenditure, minimize cost meet the target in time and optimal use of resource.

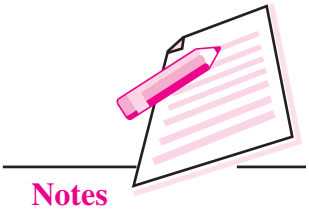
2.5 STRATEGY OF PLANNING

By strategy we mean the use of correct approach /method/formula for achieving the target under planning. In the first plan period of 1951-56, no specific strategy was adopted during this time the government of India gave more emphasis to agriculture keeping in view the fact that majority of India's population depend on agriculture and there was the immediate issue of adequate food grain supply to address food shortage. The first five year plan was a great success as the targeted growth rate was achieved so India was in a position to adopt a long term strategy for planning in future. The development strategy was accordingly spelt out explicitly in the second plan period of 1956-61. The strategy was to give emphasis on – 1. Industrialization, 2. Within industrialization more emphasis on heavy industries.

2.6 JUSTIFICATION OF THE STRATEGY OF INDUSTRIALIZATION

In order to address the problems related to poverty, unemployment, economic growth, self reliance etc. The Indian planners adopted the strategy of industrialization in the country in general and establishing heavy and basic industries in particular. **The arguments offered in favour of industrialization and heavy industries strategy are as follows:**

1. India's population has been over depended on agriculture resulting in crowding of rural area, pressure on land, fragmentation of land holding, underemployment and unemployment with fixed amount of land available for cultivation, more population makes the amount of per capita availability of land very small or nil. This has resulted in inequality in distribution of land and ultimately affecting agricultural production badly. Industrialization is the only answer to shift the surplus labour engaged in agriculture to industries and release the pressure on land.
2. Industrial activities provide more job opportunities than agricultural activities. So industrialization will help getting employment for the jobless in the country.
3. Industrialization is necessary for the growth of agriculture itself . Industries use raw materials from agriculture and agriculture sector needs industrial equipment and machinery such as pump set, tractor, electricity etc.
4. Establishment of basic and heavy industries must be given priority. Examples



of basic and heavy industries are iron and steel, aluminium, heavy chemicals, heavy electrical etc. These are capital goods industries. Every economy needs such type of industries because they procedure machinery and equipment needed to establish other industries which can produce consumer goods for the satisfaction of wants. So the heavy industries are the backbone of the economy.

It should be noted that after the adoption of heavy industry strategy the government of India created public sector to establish and manage such industries. Some of the examples are steel authority of India limited (SAIL), Bharat aluminium company (BALCO), Bharat heavy electrical limited (BHEL), National aluminium company (NALCO), etc.

5. Besides heavy and basic industries, Indian government has also given emphasis on developing the micro, small and medium industries. These industries are defined on the basis of investment limit and can be established by private individuals. The advantage of these industries include: promotion of self employment as well as generating employment furthers, use of local resources, reducing inequality of income as they can be owned by individuals etc.

2.7 NEW ECONOMIC POLICY

As said above, the heavy industry strategy was implemented under the ownership and management of the public sector. The government made budgetary provisions for the public sector to create infrastructure and establish industries. The process went on for more than three decades. However, an evaluation of the performance of the public sector by the government itself found that barring a few, more than half of the public sector units have been running on losses. There was gross mismanagement and labour problems falling the public sector units. It was a major shock to the government to find all these short comings of public sector. The failure of the public sector on various fronts was seen as one of the major reasons for lack of all round development of the country in the area of industrialisation, removal of poverty and unemployment etc. Hence in 1991, the central government came out with a new economic policy resolution. The main feature of this policy are:

(i) Liberalization

(ii) Privatization

(iii) Globalization

The policy is also popularly called LPG model of development.

Meaning of and Need for Liberalization

Liberalization means withdrawal of controls and regulations by the government on establishment and running of industries in the country. Till 1991, all the public sector units were practically under the government even if they were called

autonomous bodies. There were lot of interventions by the ministries of the government in functioning of the public sector. This resulted in politilization and fall in professionalism and inefficiency. In order to overcome this problem the government decided to stop political intervention in the running of the public sector units by signing a memorandum of understanding. According to this the management of public sector units will be given autonomy to function but they will also be accountable.

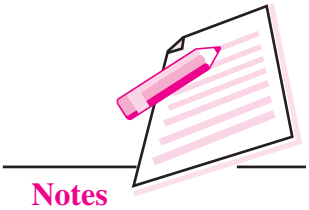
Another important feature of liberalization is to do away with the licensing system. Earlier it was mandatory for any private individual or organization to seek permission from the government to start any industrial activity. There was heavy rush and long queue before the window of the concerned government department to get a license. This system slowly gave rise to delays in getting license. Government officials started taking bribes to clear files. Such corrupt practices brought bad name to the government. So in 1991 government decided to abandon the licensing system and allowed the interested individuals to start their industrial activity without any permission. However, permission is still required only in case of strategic industries such as medicine, defence equipments etc.

Meaning of and Need for Privatization

Privatization implies opening of the door of industrial activities to the private sector which was exclusively reserved for public sector only except nuclear enemy and defence. Since basic and heavy industries were strictly under public sector there was no room for competition. The quality of product and services deteriorated due to lack of competition from other companies. As a result the consumers were the major looser because they did not get quality products and the delivery system and other services were also very poor. So the government decided to allow and encourage the entry of private sector in the areas earlier reserved for public sector only. As a result private sector entry was seen in tele communication, civil aviation etc. The government also decided to disinvest some of the public sector companies by selling part of their assets to public.

Meaning of and Need for Globalization

Globalization is a process in which attempts are made by the different countries in the world to allow free flow of goods and services, labour technology, investments etc. India is a member of world trade organization (WTO) which is the nodal agency to promote globalization. In 1991 industrial policy, India adopted soft attitude towards foreign companies to do their business in India in order to promote competition. It also committed itself to abolish or reduce tariff on import of commodities. On the otherhand, India also adopted policies to promote exports. The government also allowed foreign companies to hold 51 percent share or more



in case of their collaboration with Indian companies so that they can function freely and as the owner. This will also facilitate transfer of latest technology into Indian territory.

INTEXT QUESTIONS 2.3

1. Liberalization aims at retaining the licencing system. True or False
2. Privatization policy will help in enhancing competition in the market. True or False
3. Globalization aims at imposing tariff on imported goods. True or False

2.8 ACHIEVEMENTS OF ECONOMIC PLANNING

Economic planning in India was started in 1951. As said earlier, there were certain objective of economic planning which include: achieving economic growth in terms of increase in real national and per capita income, increase in the level of employment, removal of inequality in the distribution of income removal of poverty, ensuring social and economic justice etc. By 2014, India has completed 63 years of planning and has entered into twelfth plan period. It is high time to know the achievements of planning keeping in view its objectives. Let us discuss them.

1. Achievements in Economic Growth

Achieving economic growth was a major objectives of planning. To achieve growth it is necessary to achieve increase in national income and per capita income as well as increase in production of agricultural and industry sectors. A review of different plans shows that, the first five year plan was a success as it achieved a growth rate of 3.6 per cent against a target of 2.1 percent growth rate in national income. Then except for 5^{th} and 6^{th} plans, during the other plan periods i.e. from second to eleven five year plan the targeted growth rate in national income could not be achieved.

Similarly, The per capita income has attained growth but the rate of growth has been very slow. For example : During the first 30 years of planning the per capita income grew at a very slow rate of 1.2 per cent per year. Recently this growth rate has increased to some extent. Coming to agriculture, the food grain production has gone up from 51 million tones at the beginning of the first plan to 257.4 million tones in 2011-12. Particularly the production of rice, wheat has been spectacular, but production of pulses and oil seeds etc., has been below target.

In terms of industrial development, a major achievement has been the diversification of Indian industries. There has been expansion of transport and communications, growth in generation and distribution of electricity and considerable progress in steel, aluminium, engineering goods, chemicals, fertilizers and petroleum products.

During the planning period, the per capita availability consumer goods and other essential items has increased considerably. The goods worth mentioning here include-cereals, sugar, milk, egg, edible oil, tea, cloth and electricity.

2. Creation of Infrastructure

India has achieved a great deal in the area of creation of infrastructure. There has been large expansion roads and railway networks. Domestic air travel has increased significantly. Expansion of irrigation and hydro-electric projects has given boost to agricultural production. There has been growth in establishment of towns and cities due to increase in urban infrastructure. Communication network in the form of mobile telephony, internet has expanded tremendously.

3. Development in Education

One of the brightest areas of achievements of planning has been the development in education in India. There has been a significant increase in the enrolment of children at school level. There are 378 universities and 18,064 colleges in India which is a good development for higher education. India has also 1.52 lakh higher secondary and 10.43 lakh primary and upper primary schools.

4. Development of Science and Technology

Another significant area of achievement has been the growth in science and technology including the increase in technical and skilled manpower. India's march in space research has been noticed by the developed countries. It has made impact in the field of nuclear energy as well. Today India's Dependence on foreign experts for consultation has reduced. On the contrary it is now able to send technical experts to many foreign countries in the middle east, Africa etc.

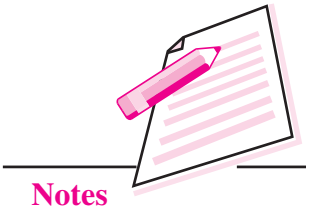
5. Expansion of Foreign Trade

Due to industrialization in the country, India's dependence on import of capital goods has delivered. Many items, which were imported earlier are being produced domestically. Due to industrial progress, India is also able to export manufacturing and engineering goods.

INTEXT QUESTIONS 2.4

1. During which plan period, the actual growth rate of national income was more than the targeted growth rate.

   (a) Second plan (b) First plan



(c) Eleventh plan (d) Ninth plan

2. The growth rate of per capita income was higher in the beginning of plan period as compared to the period in the beginning of 21st century.

True or False.

2.9 DRAWBACKS OR FAILURES OF PLANNING

Besides the achievements as told above, there are many unfulfilled tasks which the planning in India is yet to achieve completely.

1. Failure to Remove Poverty and Inequality completely :

Even after more than sixty years of planning, India has not been able to remove poverty completely. More than 240 million people are still under absolute poverty according to official estimates. The situation is worse in rural area. The government has introduced many antipoverty measures. But they have not been very successful so far.

Similarly, there is no significant improvement in the distribution of income and asset holding resulting in existence of inequality. The number of lanless agricultural labourers is very high as compared to the land holding population. The process of industrialization has helped some big industrial houses. This has resulted in concentration of economic wealth and power in few hands. This trend must be reversed if India wants to achieve equity and social justice.

2. Problem of Unemployment Persists :

Inspite of growth in income and output, India's employment situation has not improved much. Due to faster growth of population and labour force the situation has worsened further. According to official estimates India's unemployment rate is 6.6%. There is also huge backlog of unemployment due to lack of creation of required amount of jobs every year.

3. Failure to Curtail Corruption and Black Money :

Existence of rampant corruption in various public offices is a matter of grave concern in India. Common person faces a lot of problem in getting things done without giving bribe. Infact corruption has become a major political issue in elections. Various forms of corruption include paying or accepting bribe, non-payment of tax to government, political influence to get contract, secret understanding among sellers to increase price etc. Corruption has given rise to black money which is not accounted anywhere but very much in circulation. A sizeable portion of India's GDP is unaccounted . Black money creates inflation and

pressure in the society. It is also the root cause of inequality in distribution of income as people who possess black money grow richer at the cost of common citizen.

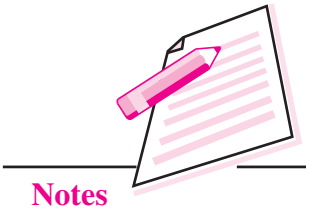
WHAT YOU HAVE LEARNT

- To solve its various economic problems India adopted Five year plans starting from 1951.
- The objectives of planning include : economic growth, increase in employment, removal of inequality and poverty and achieving social justice and equity.
- India adopted the strategy of industrialization with emphasis on basic and heavy industries to achieve the desired objectives.
- Even if the national income and the per capita income of India have recorded growth rates during planning period, the growth rates are below the target.
- India's progress in infrastructure, education, science and technology and foreign trade has been note worthy.
- Significant drawbacks of planning in India include inability to eradicate poverty, inequality and unemployment completely.
- Corruption in public places and prevalence of black money are major threats to development in India.
- In 1991 the government adopted new economic policy in order to rectify the problems associated with public sector to promote industrialization and to achieve faster economic growth.
- The new economic policy is called LPG model i.e. Liberalization, Privatization and globalization.
- LPG policy aims at removing licensing policy, promoting competition in the market and encouraging free trade in the world.

TERMINAL EXERCISE

Short answer type questions

1. Give the meaning of planning ?
2. Write two objectives of planning in India ?
3. Name two types of resources needed for planning with examples ?
4. Give one justification for adopting the strategy of industrialization ?



Long answer type questions

1. Explain the steps involved in the process of planning ?
2. Discuss the objectives of removal of inequality and poverty ?
3. Which strategy did India adopt to achieve the plan target and why ?
4. Explain the objectives of economic growth and increase in employment under planning in India ?
5. Explain 3 achievements of economic planning in India ?
6. Evaluate the performance of planning in removing poverty and inequality ?
7. Write a short note on achievement of planning with respect to economic growth?
8. Comment on the development of infrastructure in India?
9. Give reasons for adopting a new economic policy?
10. Explain the LPG model of the government to promote economic growth?

ANSWERS TO INTEXT QUESTIONS

2.1

1. (a) 2. (b) 3. (c) 4. (d)

2.2

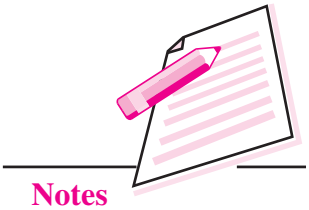
1 (a) 2. (b)

2.3

1. False 2. True 3. False

2.4

1. (b) 2. False



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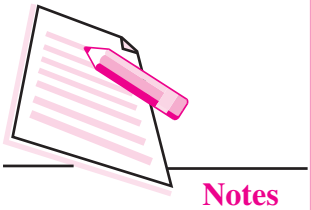
ECONOMIC GROWTH AND ECONOMIC DEVELOPMENT

Economics is all about making smart choices to cope with scarcity. The most fundamental measurement used to evaluate the success in allocating the scarce resources is economic growth. Individuals monitor their **income** and the changing value of their **assets**. Businesses track their **profits** and their **market share**. Nations monitor a variety of statistics to measure economic growth such as **national income, productivity etc.** Moving beyond growth and productivity, some economists argue that any assessment of the nation's economy must also include measurements of distribution, equity, per-capita income etc. Further, the country should also focus on other needs of a society, like environmental justice or cultural preservation to sustain the economic growth process and allows an overall human development in the economy through creation of more opportunities in the sectors of education, healthcare, employment and the conservation of the environment.

OBJECTIVES

After completing this lesson, you will be able to:

- define the meaning of Economic Growth and Economic Development, and their differences;
- explain the concept of Sustainable Development and Human Development;
- list out the factors affecting Economic Growth; and
- describe the broad Features of the Underdeveloped countries.



Notes

3.1 ECONOMIC GROWTH

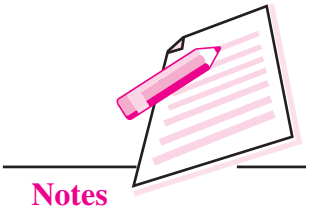
The term economic growth is defined as the process whereby the country's real national and per capita income increases over a long period of time.

This definition of economic growth consists of the following features of economic growth:

- **Economic Growth implies a process of increase in National Income and Per-Capita Income.** The increase in Per-Capita income is the better measure of Economic Growth since it reflects increase in the improvement of living standards of masses.
- **Economic Growth is measured by increase in real National Income and not just the increase in money income or the nominal national income**. In other words the increase should be in terms of increase of output of goods and services, and not due to a mere increase in the market prices of existing goods.
- **Increase in Real Income should be Over a Long Period**: The increase of real national income and per-capita income should be sustained over a long period of time. The short-run seasonal or temporary increases in income should not be confused with economic growth.
- **Increase in income should be based on Increase in Productive Capacity:** Increase in Income can be sustained only when this increase results from some durable increase in productive capacity of the economy like modernization or use of new technology in production, strengthening of infrastructure like transport network, improved electricity generation etc.

3.2 ECONOMIC DEVELOPMENT

Economic development is defined as a sustained improvement in material well being of society. Economic development is a wider concept than economic growth. Apart from growth of national income, it includes changes – social, cultural, political as well as economic which contribute to material progress. It contains changes in resource supplies, in the rate of capital formation, in size and composition of population, in technology, skills and efficiency, in institutional and organizational set-up. These changes fulfill the wider objectives of ensuring more equitable income distribution, greater employment and poverty alleviation. In short, economic development is a process consisting of a long chain of inter-related changes in fundamental factors of supply and in the structure of demand, leading to a rise in the net national product of a country in the long run.



The economic growth is a narrow term. It involves increase in output in quantitative terms but economic development includes changes in qualitative terms such as social attitudes and customs along with quantitative growth of output or national income.

Economic development without growth is almost inconceivable. The comparison between the two concepts is given in the following table:

3.3 COMPARISON CHART: ECONOMIC GROWTH VS. ECONOMIC DEVELOPMENT

	Economic Growth	Economic Development
Meaning	Economic growth refers to an increase in the real output of goods and services in the country.	Economic development implies changes in income, savings and investment along with progressive changes in socio-economic structure of country (institutional and technological changes).
Factors:	Growth relates to a gradual increase in one of the components of Gross Domestic Product: consumption, government spending, investment, net exports.	Development relates to growth of human capital, decrease in inequality figures, and structural changes that improve the quality of life of the population.
Measurement:	Economic Growth is measured by quantitative factors such as increase in real GDP or per capita income	The qualitative measures such as HDI (Human Development Index), gender- related index, Human poverty index (HPI), infant mortality, literacy rate etc. are used to measure economic development.
Effect: **Relevance:**	Economic growth brings quantitative changes in the economy. Economic growth reflects the growth of national or per capita income.	Economic Development leads to qualitative as well as quantitative changes in the economy. Economic development reflects progress in the quality of life in a country.

INTEXT QUESTION 3.1

1. "Economic Development is a wider concept than Economic Growth". Do you agree with the statement?

3.4 SUSTAINABLE DEVELOPMENT

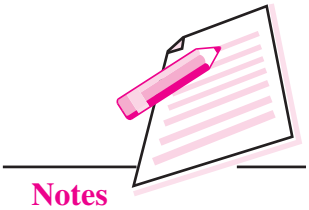
Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development includes the protection of future economic growth and future development. In other words, it means a better quality of life for everyone, now and for generations to come. Sustainable development includes the protection of future economic growth and future development. Growth is essential, but sustainable development requires it to be different. It must become more concerned about the physical environment not only to present generation, but to the future generation also. It means that the current consumption cannot be financed for long by increasing economic debt and ecological imbalance which future generation will pay. Sustainable development constantly seeks to achieve social and economic progress in ways that will not exhaust the earth's finite natural resources. Sustainable development is a process of development in which economic and other policies are designed to bring about development which is economically, socially and ecologically sustainable. The concept thus is pro-people, pro-job and pro-nature. It gives highest priority to poverty reduction, productive employment, social integration and environmental regeneration.

The sustainable development thus requires

- Preservation of Ecological Resources and greater use of renewable resources.
- Encouragement to the use of environmentally-safe technologies for development purposes i.e. focus on reduction of all kinds of pollution involved in the economic activities.
- Formulation and implementation of policy framework for people-security and human justice, including ecological and economic security.

3.5 HUMAN DEVELOPMENT

According to the United Nation's Development Programme (UNDP), human development may be defined as "a process of enlarging people's choices." At all levels of development, the three essential choices for people include to live a long and healthy life, to acquire better knowledge and to have access to resources needed for a decent standard of living. If these essential choices are not available, many other opportunities to improve the quality of life will remain inaccessible. Human development has two dimensions: acquiring human capabilities and the use



of these acquired capabilities for productive, leisure and other purposes. The benefits of human development go far beyond the expansion of income and wealth accumulation because people constitute the very essence of human development. Human development is about much more than economic growth. The economic growth focuses on the improvement of one option i.e. income or product while human development focus on enlarging all human options including education, health, clean environment and material well being. Thus, the options available for improving people's lives are influenced by the quality of economic growth in its wider sense, and the impact is by no means confined to quantitative aspects of such growth. In other words, economic growth needs to be seen as a means, albeit an important one, and not the ultimate goal, of development. Income makes an important contribution to human well-being, broadly conceived, if its benefits are translated into more fulfilled human lives. But the growth of income is not an end in itself. It is the quality of growth, not its quantity alone, which is crucial for human well-being.

Thus, the concept of human development, is concerned mainly with enabling people to enjoy a better life as the ultimate goal of human endeavor. Highlights that this goal cannot be achieved solely through improvements in income or material well-being.

As the 1996 Human Development Report put it, growth can be jobless, rather than job creating; ruthless, rather than poverty-reducing; voiceless, rather than participatory; rootless, rather than culturally enshrined; and futureless, rather than environment-friendly. Economic growth which is jobless, ruthless, voiceless, rootless and futureless is not conducive to human development. The lack of income or income poverty is only one aspect of human impoverishment; deprivation can also occur in other areas– having a short and unhealthy life, being illiterate or not allowed to participate, feeling personal insecurity, etc. Human poverty is thus larger than income poverty.

3.6 MEASURING HUMAN DEVELOPMENT: HUMAN DEVELOPMENT INDEX (HDI)

As stated earlier three dimensions of Human Development are capabilities of people to lead a long and healthy life, to acquire knowledge and to have access to resources needed for a decent standard of living. The combined effect of various components of human development is measured through Human Development Index (HDI). The HDI contains four variables: life expectancy at birth, to represent the dimension of a long, healthy life; adult literacy rate and combined enrolment rate at the primary, secondary and tertiary levels to represent the knowledge dimension; and real GDP per capita to serve as a proxy for the resources needed for a decent standard of living. HDI thus looks not only at GDP

growth rate but takes into account education, health, gender inequality and income parameters to measure human development of a country.

As per the latest available Human Development Report (HDR) 2013 published by the United Nations Development Programme (UNDP) (which estimates the human development index [HDI] in terms of three basic capabilities: to live a long and healthy life, to be educated and knowledgeable, and to enjoy a decent economic standard of living), the HDI for India was 0.554 in 2012 with an overall global ranking of 136 (out of 186 countries) compared to 134 (out of 187 countries) as per HDR 2012. India's HDI has risen by 1.7% annually since 1980.

INTEXT QUESTION 3.2

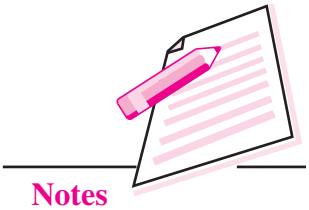
1. Human development is a better measure of economic development as it places human-beings at the centre stage of development. Discuss.

3.7 FACTORS AFFECTING ECONOMIC GROWTH

The process of economic growth is a highly complex phenomenon and is influenced by numerous and varied factors such as political, social and cultural factors. These factors are as follows:

A. Economic Factors

1. **Natural Resources:** The principal factor affecting the development of an economy is the natural resources. The natural resources include the land area and the quality of the soil, forest wealth, good river system, minerals and oil resources, good climate, etc. For economic growth, the existence of natural resources in abundance is essential. A country deficient in natural resources may not be in a position to develop rapidly. However, the availability of rich natural resources are a necessary condition for economic growth but not a sufficient one. In less developed countries, natural resources are unutilized, underutilized or misutilised. This is one of the reasons of their backwardness. On the otherhand countries such as Japan, Singapore etc. are not endowed with abundant natural resources but they are among the developed nations of the world. These countries have shown committment towards preserving the available resources, putting best efforts to manage the resources, minimizing waste of resources etc.
2. **Capital Formation:** Capital formation is another important factor for development of an economy. Capital formation is the process by which a community's savings are channelised into investments in capital goods such as plant, equipment and machinery that increases nation's productive capacity and worker's efficiency thus ensuring a larger flow of goods and services in a



country. The process of capital formation implies that a community does not spend whole of its income on goods for current consumption, but saves a part of it and uses it to produce or acquire capital goods that greatly add to productive capacity of the nation.

3. **Technological Progress**: Technological progress is a very important factor in determining the rate of economic growth. Technological progress mainly implies the research into the use of new and better methods of production or the improvement of the old methods. Sometimes technical progress results in the availability of natural resources. But generally technological progress results in increase in productivity. In other words, technological progress increases the ability to make a more effective and fruitful use of natural and other resources for increasing production. By the use of improved technology it is possible to have greater output from the use of given resources or a given output can be obtained by the use of a smaller quantity of resources. The technological progress improves an ability to make a fuller use of the natural resources e.g. with the aid of power - driven farm equipment a marked increase has been brought about in agricultural production. The USA, UK, France, Japan and other advanced industrial nations have all acquired the industrial strength from use of advanced technology. In fact economic development is facilitated with the adoption of new techniques of production.

Entrepreneurship

Entrepreneurship implies an ability to find out new investment opportunities, willingness to take risks and make investment in the new and growing business units. Most of the underdeveloped countries in the world are poor not because there is shortage of capital, weak infrastructure, unskilled labor and deficiency of natural resources, but because of acute deficiency of entrepreneurship. It is, therefore, essential in the under-developed nations to create climate for promoting entrepreneurship by emphasizing education, new researches, and scientific and technological developments

4. **Human Resources Development:** A good quality of population is very important in determining the level of economic growth. So the investment in human capital in the form of educational and medical and such other social schemes is very much desirable. Human resource development increases the knowledge, the skills and the capabilities of the people that increase their productivity.

5. **Population Growth:** Labor supply comes from population growth and it provides expanding market for goods and services. Thus, more labor produces larger output which a wider market absorbs. In this process, output, income and employment keep on rising and economic growth improves. But the population growth should be normal. A galloping rise in population retards

economic progress. Population growth is desirable only in a under-populated country. It is, however, unwarranted in an overpopulated country like India.

6. **Social Overheads:** Another important determinant of economic growth is the provision of social overheads like schools, colleges, technical institutions, medical colleges, hospitals and public health facilities. Such facilities make the working population healthy, efficient and responsible. Such people can well take their country economically forward.

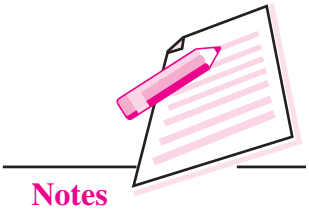
Non-Economic Factors

Non-Economic factors that include socio-economic, cultural, psychological and political factors are also equally significant as are economic factors in economic development. We discuss here some of the essential non economic factors which determine the economic growth of an economy.

1. **Political Factors:** Political stability and strong administration are essential and helpful in modern economic growth. The stable, strong and efficient government, honest administration, transparent policies and their efficient implementation develop confidence of investors and attracts domestic as well as foreign capital that leads to faster economic development.
2. **Social and Psychological Factors:** Social factors include social attitudes, social values and social institutions which change with the expansion of education and transformation of culture from one society to the other. The modern ideology, values, and attitudes bring new discoveries and innovations and consequently to the rise of the new entrepreneurs. The outdated social customs restricts occupational and geographical mobility and thus pose an obstacle to the economic development.
3. **Education:** It is now fairly recognized that education is the main vehicle of development. Greater progress has been achieved in those countries, where education is wide spread. Education plays an important role in human resource development, improves labor efficiency and removes mental block to new ideas and knowledge thus contributes to economic development.
4. **Desire for Material Betterment:** The desire for material progress is a necessary precondition for economic development. The societies that focus on self-satisfaction, self-denial, faith in fate etc. limit risk and enterprise and thus keep the economy backward.

INTEXT QUESTION 3.3

1. Non-economic factors are as much important in economic development as economic factors. Comment.



3.8 COMMON FEATURES OF UNDERDEVELOPED COUNTRIES

1. **Low per Capita Income:** The level of per capita income is very low in underdeveloped countries.
2. **Poor Level of Living:** The vast majority of people in underdeveloped nations lie under the conditions of poverty, malnutrition, disease, illiteracy, etc. Even basic necessities of life such as minimum food clothing and shelter are not easily accessible to the poor masses.
3. **High Rate of Growth of Population:** Population growth in underdeveloped countries neutralizes economic growth. High population implies greater consumption expenditure and lower investments in productive activities and slows down the economic development.
4. **Highly Unequal Income Distribution:** The income inequality between the rich and the poor people within the underdeveloped countries is also very high.
5. **Prevalence of Mass Poverty:** Low level of per capita income combined with high degree of inequalities in its distribution leads to widespread poverty in underdeveloped countries.
6. **Low Levels of Productivity:** The Productivity level (i.e. output produced per person) tends to be very low in an underdeveloped country which is mainly due to : (i) inefficient workforce which itself is a consequence of poverty, ill health and lack of education (ii) Low work culture (iii) Low use of capita in the form of machinery and equipment.
7. **Low Rate of Capital Formation:** The saving rate in an underdeveloped country is quite low and rate of capital formation is also is very slow.
8. **Technological Backwardness:** In most of the sectors, an underdeveloped economy the techniques of production employed are generally obsolete mainly due to low saving rate.
9. **High Level of Unemployment:** Unemployment levels are very high in the underdeveloped countries mainly due to lack of capital and low level of development in various economic sectors, these countries are not able to absorb the rising labor supply.
10. **Low Social Indicators of Development:** The under-developed countries have very low social indicators such as low literacy rate, high infant mortality rate, low expectancy of life, etc. as compared to the developed countries.

INTEXT QUESTIONS 3.4

1. Which of the following characteristics are most likely found in developing countries?

(a) high population growth rates.

(b) large number of people living in poverty.

(c) very traditional methods of agricultural production.

(d) all of the above

(e) none of the above

2. Economic development refers to

(a) economic growth.

(b) economic growth plus changes in output distribution and economic structure.

(c) sustainable increases in Gross National Product.

3. The common measure of economic development is

(a) The level of health and education of the population.

(b) The rate of population growth.

(c) Per Capita GDP

(d) All of the above

(e) None of the above.

4. developing nations have

(a) A lower infant mortality rate.

(b) A greater degree of equality in the income distribution.

(c) lower rate of illiteracy.

(d) None of above.

5. Sustainable development involves

(a) Reducing Consumption, increasing efficiency and using renewable energies.

(b) better transportation by building more roads

(c) Using Resources at maximum rates.

6. Sustainability is the use of a resource that doesnot cause long term depletion of resources or affect the diversity of the ecosystem.

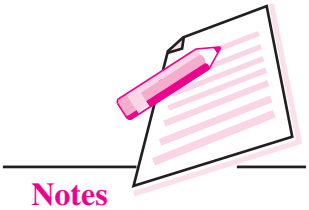
(a) True.

(b) False.

7. Which three indicators are currently used in the Human Development Index (HDI):

(a) real GDP per capita

(b) Birth rates



(c) Life expectancy at birth

(d) Employment Rates

(e) Educational attainment.

WHAT YOU HAVE LEARNT

- Economic growth implies a process of increase in real national income and real per capita income.
- Economic development is defined as a sustained improvement in material well being of society.
- Sustainable development in development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- Human development may be defined as "a process of enlarging people's choices".
- According to UNDP, human Development Index (HDI) includes three basic capabilities (indicators) to live a long and healthy life, to be educated and knowledgeable and to enjoy a decent economic standard of living.
- Economic factors affecting growth and development are: natural resources, capital formation, technological progress, entrepreneurship, human resource development, population growth and social overheads.
- Non-economic factors affecting growth and development are: political factors, social and psychological factors, education and desire for material betterment.
- Common features of developing countries are: (i) Low per capita income, (ii) Poor level of living, (iii) High rate of growth of population, (iv) Highly inequal income distribution, (v) Prevalence of mass poverty, (vi) Low levels of productivity, (vi) Low rate of capital formation, (viii) Technological backwardness, (ix) High level of unemployment, and (x) Low social indicators of development.

TERMINAL EXERCISE

1. What is economic growth? Do you think that economic growth and economic development are two names for the same concept?

   Hint: Meaning of economic growth and difference between economic growth and economic development.

2. There is no automatic link between economic growth and human development. Discuss.

Hint: Meaning of human development and difference between economic growth and human development.

3. What are the common features of Underdeveloped countries?

   Hint: features of underdeveloped countries.

4. What are the important components of the Human Development Index (HDI)

   Hint: meaning of HDI

5. Explain the meaning of Sustainable development.

   Hint: Concept of sustainable development.

ANSWERS TO INTEXT QUESTIONS

3.1

1. Difference between economic growth and economic development.

3.2

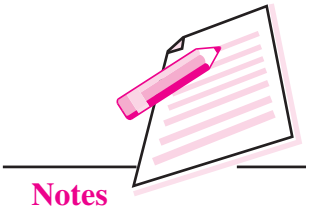
1. Meaning of human development.

3.3

1. Economic and Non-economic factors of growth.

3.4

1. (d) 2. (b) 3. (c) 4. (d) 5. (a) 6. (a)
7. (a), (c) and (e)



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THE PROBLEM OF UNEMPLOYMENT, POVERTY AND INEQUALITY

In India, the problems of unemployment and poverty have always been major obstacles to economic development. Regional disparity is also crucial in this context. Economic reforms, changes in the industrial policy and better utilization of available resources are expected to reduce the problem of unemployment and poverty. The governmental bodies are also required to initiate long term measures for poverty alleviation. Generation of employment opportunities and equality in income distribution are the two key factors that are of utmost important to deal with the dual problem of unemployment and poverty.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning, types and important measures of unemployment;
- identify the causes of unemployment;
- know the Government policies and programmes implemented to alleviate poverty and generate employment; and
- evaluate the extent and causes of regional disparity in India.

4.1 MEASUREMENT AND MAGNITUDE OF UNEMPLOYMENT IN INDIA

4.1.1 Meaning and Types of Unemployment

The population of any country consists of two components **(i) Labor Force (ii) Non-Labor Force.** Labor force means all persons who are working (i.e. being engaged in the economic activity) as well as those who are not working but are

seeking or available for work at the current wage rate. It means the labor force consists of both employed and unemployed people.

The component of population which is not a part of the labor force is Non-Labor Force. It includes all those who are not working and are neither seeking nor available for work.

Unemployment can be defined as a state of workless ness for a person who is fit and willing to work at the current wage rate. It is a condition of involuntary and not voluntary idleness. Simply stated an unemployed person is the one who is an active member of the labor force and is seeking work, but is unable to find the same. In case of voluntary unemployment a person is out of job on his own accord or choice, doesn't work on the prevalent or prescribed wages. Either he wants higher wages or doesn't want to work at all. The involuntary unemployment on the other hand is the situation when a person is separated from remunerative work and devoid of wages although he is capable of earning his wages and is also anxious to earn them. It is the involuntary idleness that constitutes unemployment. Involuntary unemployment can be further divided into cyclical unemployment, seasonal unemployment, structural unemployment, frictional unemployment, natural rate of unemployment, disguised unemployment and under employment.

4.1.1.1 Cyclical Unemployment

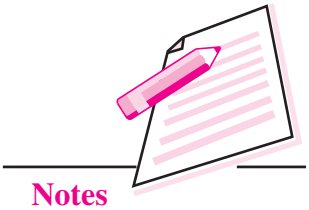
Cyclical or demand deficient unemployment occurs when the economy is in need of low workforce. When there is an economy-wide decline in aggregate demand for goods and services, employment declines and unemployment correspondingly increases. Cyclical unemployment mainly occurs during recession or depression. This form of unemployment is most commonly known as cyclical unemployment since unemployment moves with the trade cycle. For instance, during the recent global slowdown in late 2008, many workers around the globe lost their jobs.

4.1.1.2 Seasonal Unemployment

This type of unemployment occurs in a particular time of the year or season and thus is known as seasonal unemployment. Seasonal unemployment is most common in industries like agriculture, tourism, hotel, catering etc.

4.1.1.3 Structural Unemployment

Structural unemployment arises when the qualification of a person is not sufficient to meet his job responsibilities. It arises due to long term change in the pattern of demand that changes the basic structure of the economy. The person is not able to learn new technologies used in the new expanding economic sectors and they thus may be rendered permanently unemployed. For instance, when computers were



introduced, many workers were dislodged because of a mismatch between the existing skills of the workers and the requirement of the job. Although jobs were available, there was a demand for a new kind of skill and qualification. So, persons with old skills did not get employment in the changed economic regime, and remain unemployed.

4.1.1.4 Frictional Unemployment

Frictional unemployment occurs when a person is out of one job and is searching for another for different reasons such as seeking a better job, being fired from a current job, or having voluntarily quit a current job. It generally requires some time before a person can get the next job. During this time he is frictionally unemployed.

4.1.1.5 Natural rate of unemployment

The sum total of frictional and structural unemployment is referred as the natural rate of unemployment.

4.1.1.6 Disguised Unemployment

The unemployment which is not visible is said to be disguised unemployment. It occurs when a person doesn't contribute anything to the output even when visibly working. This happens amongst family labor especially in agriculture who are engaged on land but are not contributing to the given level of output. Thus their marginal productivity is zero.

4.1.1.7 Underemployment

When a person is engaged in the economic activity but that fail to provide him fully in accordance to his qualification and efforts. Thus it is a situation in which a person is employed but not in the desired capacity whether in terms of compensation, hours, or level of skill and experience. While not technically unemployed the underemployed often compete for available jobs.

4.2 MEASUREMENT OF UNEMPLOYMENT

Unemployment rate is the percent of the labor force that is without work. It is calculated as below:

Unemployment rate = (Unemployed Workers/Total labor force) × 100

Measurement of unemployment is a difficult task. In India, the most comprehensive and reliable data on employment and unemployment are compiled by the National Sample Survey Organization (NSSO). Based on different reference period (a year, a week, and each day of a week), NSSO provides four different measures of

employment and unemployment. The following are some methods of measuring unemployment:

(i) **Usual Principal Status Unemployment (UPS):** This is measured as the number of persons who remained unemployed for a major part of the year. The persons covered by the survey may be classified into those working and/or available for work in their principal activity, and those working and/or available for work in a subsidiary activity, that is, a sector other than their principal activity. Hence, within the usual status concept, the estimates are now derived on the usual principal status as well as the usual principal and subsidiary status basis. The usual status unemployment rate is a person rate and indicates chronic unemployment, because all those who are found usually unemployed in the reference year are counted as unemployed. This measure is more appropriate to those in search of regular employment, e.g., educated and skilled persons who may not accept casual work. This is also referred to as 'open unemployment'.

(ii) **Usual Principal and Subsidiary Status Unemployment (UPSS):** Here person is considered unemployed, if besides UPS, those available but unable to find work on a subsidiary basis during a year.

(iii) **Current Weekly Status Unemployment (CWS):** This refers to the number of persons who did not find even an hour of work during the survey week.

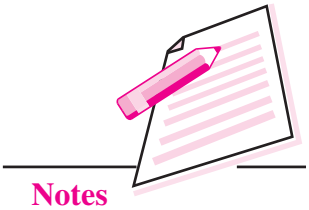
(iv) **Current Daily Status Unemployment (CDS):** This refers to the number of persons who did not find work on a day, or on some days, during the survey week.

Rates of unemployment differ based on different concepts. The UPS and UPSS measure reflect only long term unemployment spells. The CWS measure captures shorter unemployment spells, but ignores unemployment for less than a week. The CDS measure is the most inclusive, capturing both open as well as partial unemployment. The unemployment rate based on different measures is given under the following table 4.1:

Table 4.1: Unemployment Rate (%)

Year	2004-05	2009-10	2010-11
UPSS	2.3	2.0	2.2
CWS	4.4	3.6	3.7
CDS	8.2	6.6	5.6

Source: NSSO Surveys, till 2014



It is clear from the above table that there is decline in the unemployment rate since 2004-05. UPSS has remained more or less same between 2004-05 to 2010-11 at marginally above 2 per cent. CWS declined from 4.4 per cent in 2004-05 to 3.6 in 2009-10 and almost remained same at 3.7 in 2010-11. CDS decreased continuously from 8.2 per cent in 2004-05 to 6.6 per cent in 2009-10 and 5.6 per cent in 2010-11

4.3 CAUSES OF UNEMPLOYMENT IN INDIA

4.3.1 Slow Economic Growth

During the planning period the trend rate of growth was considerably lower than the targeted rate. Therefore, jobs in adequate number were not created. Further, economic growth by itself does not solve the problem of unemployment. In the recent past there has been deceleration in the growth of employment in spite of the accelerated economic growth. This can be explained in terms of steady decline in the degree of response of employment to change in output in all the major sectors of economic activity except in construction. According to T.S. Papola, over a period of time, the output growth in agriculture and manufacturing sector has become more input and technology-intensive and less labor-intensive. Besides, the sectoral composition of growth is also an important determinant of unemployment. Excessive dependence on agriculture and slow growth of non-farm activities limit employment generation.

4.3.2 Increase in Labor force

There are two important factors that have caused an increase in the labor force which are as follows:

(i) **Rapid Population Growth:** Rising population has led to the growth in the labor supply and without corresponding increase in the employment opportunities for the increasing labor force has aggravated the unemployment problem.

(ii) **Social Factors:** Since Independence, education among women has changed their attitude toward employment. Many of them now compete with men for jobs in the labor market. The economy has however failed to respond to these challenges and the net result is a continuous increase in unemployment backlogs.

4.3.3 Rural-Urban Migration

The unemployment in urban area is mainly the result of substantial rural migration to urban areas. Rural areas have failed to provide subsistence living in agriculture

and allied activities and so large scale migration is taking place to cities. However, economic development in cities has failed to create enough additional jobs for the new urban entrants to the labor market. Thus only some of the migrants are absorbed in productive activities and the rest join the reserve army of unemployed workers.

4.3.4 Inappropriate Technology

In India, though capital is a scarce factor, labor is available in abundant quantity; yet producers are increasingly substituting capital for labor. This policy results in larger unemployment. Despite the abundance of labor, capital intensive technology is adopted in India mainly because of rigid labor laws. It is quite difficult to follow easy hire and fire policy and so right sizing of manpower is difficult for the enterprises. It is difficult to reduce the number of labor-Force. Further, the factors like labor-unrest and lack of work-culture leads to the increased inefficiency of labor and thus provide incentives to follow labor-saving technology by organizations.

4.3.5 Defective Educational System

The present educational system has theoretical bias and has limited utility for productive purposes. It lacks the emphasis on the development of aptitude and technical qualifications required for various types of work among job seekers. This has created a mismatch between the need and availability of relevant skills and training, which results in unemployment, especially of youth and educated while shortage of technical and specialized personnel continues.

4.3.6 Lack of Infrastructure Development

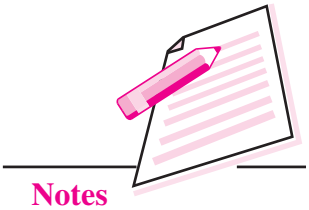
Lack of investment and infrastructure development limits the growth and productive capacity of different sectors which leads to inadequate generation of employment opportunities in the economy.

4.3.7 Lack of employability

India faces poor health and nutrition situation among masses which reduces the capacity of person to be employable and it causes unemployment.

INTEXT QUESTION 4.1

1. What is unemployment rate? How is it measured in India?
2. What are the causes of increase in labor force in India?



4.4 POVERTY IN INDIA

In general, poverty can be defined as a situation when people are unable to satisfy the basic needs of life. The definition and methods of measuring poverty differs from country to country. The extent of poverty in India is measured by the number of people living below the **Poverty Line.**

4.4.1. Poverty Line

The **Poverty Line** defines a threshold income. Households earning below this threshold are considered poor. Different countries have different methods of defining the threshold income depending on local socio-economic needs. The Planning Commission releases the poverty estimates in India.

Poverty is measured based on consumer expenditure surveys of the National Sample Survey Organisation (NSSO). A poor household is defined as the one with an expenditure level below a specific poverty line.

Earlier, India used to define the poverty line based on a method defined by a task force in 1979. It was based on expenditure for buying food worth 2,400 calories in rural areas and 2,100 calories in urban areas. In 2009, the Suresh Tendulkar Committee defined the poverty line on the basis of monthly spending on food, education, health, electricity and transport.

The Planning Commission has updated the poverty lines and poverty ratios for the year 2009-10 as per the recommendations of the Tendulkar Committee. It has estimated the poverty lines at all India level as an MPCE (monthly per capita consumption expenditure) of `. 673 for rural areas and `. 860 for urban areas in 2009-10. So a person who spends ` 673 in rural areas and `. 860 in urban area per month is defined as living below the poverty line.

Based on these cut-offs, the percentage of people living below the poverty line in the country has declined from 37.2 per cent in 2004-5 to 29.8 per cent in 2009-10. Even in absolute terms, the number of poor people has fallen by 52.4 million during this period. Of this, 48.1 million are rural poor and 4.3 million are urban poor. Thus poverty has declined on an average by 1.5 percentage points per year between 2004-5 and 2009-10. The annual average rate of decline during the period 2004-5 to 2009-10 is twice the rate of decline during the period 1993-4 to 2004-5 (Table).

Table 4.2: Poverty Ratios (figures are in %)

Year	Rural	Urban	Total
1993-94	50.1	31	45.3
2004-05	41.8	25.7	37.2
2009-10	33	20.9	29.8

Source: Economic Survey 2013

4.5 CAUSES OF POVERTY IN INDIA

4.5.1 Vicious Circle of Poverty:

It is said that "a country is poor because it is poor." This idea has come down from Ragnar Nurkse who pinpointed the problem of the vicious circle of poverty. Low level of saving reduces the scope for investment; low level of investment yields low income and thus the circle of poverty goes on indefinitely.

4.5.2 Low Resources Endowment

A household is poor if the sum total of income earning assets which it commands, including land, capital and labor of various levels of skills, cannot provide an income above the poverty line. The poor mainly consists of unskilled labor, which typically does not command a high enough level of wage income.

4.5.3 Inequality in the Distribution of Income and Assets:

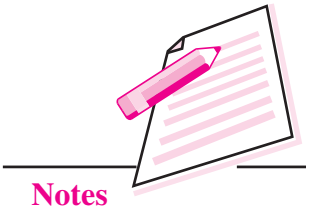
The distribution of income and assets also determine the level of income. The economic inequalities are the major cause of poverty in India. It means the benefits of the growth have been concentrated and have not "trickled down" sufficiently to ensure improved consumption among the lower income groups.

4.5.4 Lack of Access to Social Services

The lack of access to social services such as health and education compound the problems arising from inequality in the ownership of physical and human assets. These services directly affect household welfare. The poor typically get much less than a fair share of such services. This is partly because governments do not invest enough to ensure an adequate supply of these services and the limited supply is mainly availed by non-poor households. Further, the poor may not have adequate access for a variety of other reasons like lack access to information about the existence of such services, lack of knowledge and corruption.

4.5.5 Lack of access to Institutional Credit

The banks and other financial institutions are biased in the provision of loans to the poor for the fear of default in the repayment of loans. Further, the rules regarding collateral security, documentary evidences etc. present constraints for the poor to avail loan facility from banks. The inaccessibility to institutional credit may force poor to take credit from the landlord or other informal sources at a very high interest rate and which in turn may weaken their position in other areas, leading, for example, to the payment of abnormally high rental shares for land, or acceptance of abnormally low wages in various types of "bonded labour"



arrangements or selling their crop at a very low price. In some cases poor people cannot make themselves free from the clutches of moneylenders. Their poverty is further accentuated because of indebtedness. Such indebted families continue to remain under the poverty line for generations because of this debt-trap.

4.5.6 Price Rise

The rising prices have reduced the purchasing power of money and thus have reduced the real value of money income. The people belonging to low income group are compelled to reduce their consumption and thus move below the poverty line.

4.5.7 Lack of Productive Employment

The magnitude of poverty is directly linked to unemployment situation. The present employment conditions don't permit a reasonable level of living causing poverty. The lack of productive employment is mainly due to problems of infrastructure, inputs, credit, technology and marketing support. The gainful employment opportunities are lacking in the system.

4.5.8 Rapid Population Growth:

The faster population growth obviously means a slower growth in per capita incomes for any given rate of growth of gross domestic product (GDP), and therefore a slower rate of improvement in average living standards. Further the increased population growth increase consumption and reduces national savings and adversely affects the capital formation thereby limiting the growth in the national income.

4.5.9 Low Productivity in Agriculture

The level of productivity in agriculture is low due to subdivided and fragmented holdings, lack of capital, use of traditional methods of cultivation, illiteracy etc. This is the main cause of poverty in the rural India.

4.5.10 Social Causes

(i) **Education:** Education is an agent of social change. Poverty is also said to be closely related to the levels of schooling and these two have a circular relationship. The earning power is affected by investment in individual's education and training. However, poor people do not have the funds for human capital investment and thus it limits their income.

(ii) **Caste system:** Caste system in India has always been responsible for rural poverty. The subordination of the low caste people by the high caste people

caused the poverty of the former. Due to rigid caste system, the low caste people could not participate in various economic activities and so remain poor.

(iv) **Social customs:** The rural people generally spend a large percentage of annual earnings on social ceremonies like marriage, death feast etc. and borrow largely to meet these requirements. As a result, they remain in debt and poverty.

4.6 POVERTY ALLEVIATION AND EMPLOYMENT GENERATION PROGRAMMES IN INDIA

The government is following a focused approach through various flagship schemes in the areas of poverty alleviation and employment generation to achieve inclusive development.

4.6.1 Mahatma Gandhi National Rural Employment Guarantee Work (MGNREGA)

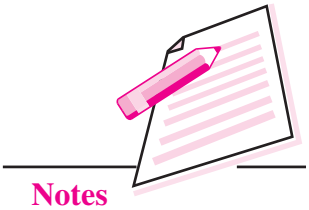
This flagship programme of the government aims at enhancing livelihood security of households in rural areas by providing at least one hundred days of guaranteed wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work with the stipulation of one-third participation of women. The MGNREGA provides wage employment while also focusing on strengthening natural resource management through works that address causes of chronic poverty like drought, deforestation, and soil erosion and thus encourage sustainable development.

4.6.2 National Rural Livelihood Mission (NRLM)- Aajeevika

The Swarnjayanti Gram Swarozgar Yojana (SGSY)/ NRLM a self-employment programme implemented since April 1999 aims at lifting the assisted rural poor families (swarozgaris) above the poverty line by providing them income-generating assets through a mix of bank credit and government subsidy. The rural poors are organized into self-help groups (SHGs) and their capacities are built through training and skill development.

4.6.3 Swarna Jayanti Shahari Rozgar Yojana (SJSRY)

The SJSRY launched on 1 December 1997 aims at providing gainful employment to the urban unemployed and underemployed, by encouraging them to set up self-employment ventures or creating wage employment opportunities.



INTEXT QUESTIONS 4.2

1. Explain the concept of poverty line in India.
2. How does availability of institutional credit impact the level of poverty in India
3. What do you mean by vicious circle of poverty?

4.7 INEQUALITY IN INDIA

India is a vibrant country with quite an impressive economic growth profile and as expected, improvement in economic growth and per capita income has translated, at least partly, into reduction in the level of poverty in the country. It is a fact that there has been a secular decline in the share of poor in the population. However, there exists a wide spread disparities in the levels of social-economic development between the different regions of the country. The huge differences in living standards as measured by per capita incomes, across the States of India range from 12000 rupees per head in Bihar to nearly 100,000 rupees per head in Goa. They are the product of history and past growth experience. There are also other related disparities in the levels of education, literacy, health, infrastructure, population growth, investment expenditure and the structure of regions. The regional disparity in the last decade shows that India has a vast array of richer and poorer regions with Goa being the richest region and Bihar the poorest. In 2010/ 11, Chandigarh was the richest, but Bihar remained the poorest. There are also substantial variations in the average annual growth rate over the period, ranging from an impressive 8.39 per cent in Chandigarh to a sluggish 2.71 per cent in Jammu & Kashmir. Further, during this decade, the top four richest regions (viz, Goa, Chandigarh, Delhi and Puducherry) have high initial levels of GDSP (Gross Domestic State Product) per head and very fast growth over the period as compared to the other regions.

4.8 CAUSES OF GROWING REGIONAL DISPARITIES IN INDIA

4.8.1. Historical Factors

Historically regional imbalance in India started from its British regime. British industrialist mostly preferred to concentrate their activities in two states like west Bengal and Maharashtra and more particularly to their metropolitan cities like Kolkata, Mumbai and Chennai. They concentrated all their industries in and around these cities neglecting the rest of the country to remain backward.

4.8.2 Geographical factors

The difficult terrain surrounded by hills rivers and dense forest, leads to increase in the cost of administration, cost of development projects, besides making mobilization of resources partially difficult. Adverse climate and floods are also responsible factors for poor rate of economic develop-ment of different regions of the country as reflected by low agricultural productivity and lack of industrialization. These factors have resulted in uneven growth of differ-ent regions of India.

4.8.3 Infrastructure

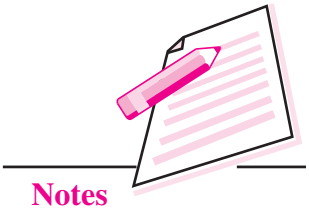
The states with well-developed basic infrastructure such as power, water, roads and airport attracts the big investment projects and so has witnessed a very high growth rate. The poorer states on other hand lacking the basic infrastructure fails to attract private investments. This has accentuated the problem of inequality in the distribution of income and concentration of economic power.

4.8.4 Decline in Public Investment

In the new economic policy the Government has been continuously limiting its role with respect to participation in economic activity and has given more space to the private sector. There has been a steady decline in the public investment. This has adversely affected the poorer states. Since the public investment is a major contributor to growth of these States through bulk investments on irrigation, power and social sector projects decline in the same has adversely affected the process of development of many regions.

INTEXT QUESTIONS 4.3

1. The percentage of labour force that is unemployed is the:
   (a) employment rate
   (b) Unemployment Population Ratio.
   (c) Unemployment rate.
   (d) Labour force rate.
2. The labour force can be defined as:
   (a) Those of workers who are seeking work and are available for work at current wage rate.
   (b) Anyone who is working or actively seeking work.
   (c) The population between school-leaving age and retrirement age.
   (d) Those who could claim benefit if they were to become unemployed.
3. Cyclical Umemployment is the:



(a) Unemployment that results when people become discouraged about their chances of finding a job so that they stop looking for work

(b) Unemployment that occurs during recessions and depressions.

(c) portion of unemployment that is due to the normal working of the labour market.

(d) portion of unemployment that is due to changes in the structure of the economy that results in a significant loss of jobs in certain industries.

4. Which among the following is the method to estimate the poverty line in India?

(a) Investment method

(b) Capital method

(c) Human method

(d) Income method.

5. Who conducts the periodical sample survery for estimating the poverty line in India?

(a) National Survery Organisation

(b) National Sample Survey Organisation

(c) Sample Survey Organisation

(d) None of the above.

6. For how many days MNREGA provides employment?

(a) 70 (b) 80

(c) 90 (d) 100

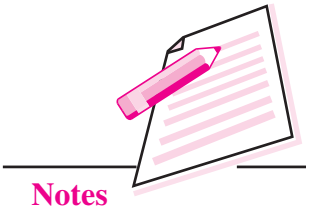
WHAT YOU HAVE LEARNT

- An able bodied person who is willing to work but he is not getting any job is called an unemployed person.
- Cyclical unemployment occurs during the time of recession where there is fall in aggregate demand in the economy.
- Seasonal unemployment is mostly found in agriculture sector, tourism etc.
- Structural unemployment is caused due to lack of adjustment of the labour force with the change in demand.
- Frictional unemployment is created when a person searches for a better job or losses his current job.
- Disguised unemployment is a situation where marginal product of labour is zero.

- Underemployment is a situation where in a person does not receive the remuneration he/she deserves from his/her present occupation and also his/her capabilities are not fully used.
- Unemployment rate is defined as the percent of the labour force that is without work.
- There are following measures of unemployment in India- Usual Principal Status (UPS), Usual Principal and Subsidiary Status Unemployment (UPSS), Current Weekly Status (CWS) and Current Daily Status (CDS).
- UPS refers to a person who could not find a job for major part of the year.
- UPSS refers to a person who could not find a job for even on a subsidiary basis for a major part of the year.
- CWS refers to a person who could not get a job even for an hour in a week.
- CDS refers to a person who could not find a job in the reference day.
- Causes of unemployment in India include: Slow Economic Growth, Rapid Population Growth, Rural-Urban Migration, Backward Technology, Lack of Education and Lack of Infrastructure.
- Poverty line is defined as the level of income or expenditure below which a person cannot sustain himself/herself at the on going market price. Poverty Line has changed over time in India.
- Causes of Poverty in India include: Lack of Resources, Income Inequality, Lack of Access to Social Services, Lack of Access to Institutional Credit, Unemployment, Inflation etc.
- Some of the antipoverty programmes of the government include: MGNREGA, NRLM, SJSRY,
- Inequality in income distribution and regional inequality are major threat to Indian economic development.

TERMINAL EXERCISE

1. What are the causes of unemployment in India?
2. Discuss the causes of poverty in India.
3. Briefly explain various poverty alleviation programmes implemented by Government of India in recent years.
4. Explain the dimension of regional inequality in India.
5. What are causes of regional inequality in India?



ANSWER TO INTEXT QUESTIONS

4.1

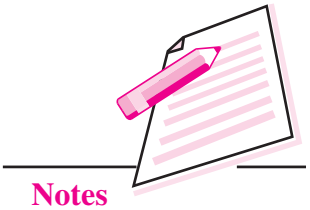
1. See section 4.2
2. See section 4.3.2

4.2

1. Poverty line (see section 4.4.1)
2. See sec 4.5.4
3. See section 4.5.1

4.3

1. (c)
2. (a)
3. (b)
4. (d)
5. (b)
6. (d)



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MEANING, SCOPE AND ITS NEED IN ECONOMICS

All of us want to know about everyday life around us. We can know about the nature of things both quantitatively and qualitatively. Many times we can express things better in quantitative terms, that is, in numbers. For example, by comparing the per capita income of India and the United States, we can say that India is a developing economy while United States is a developed economy.

The word 'Statistics' is derived from the Latin word 'statis' or the Italian word 'statists' or German word 'statistic.' All these words mean a political state. In the olden days statistics was necessary for the proper functioning of the affairs of a state. Thus, in those days Statistics was called as 'science of state' or 'science of kings' as it was mainly used by the state or kings. Today statistics is defined as a field of study relating to the collection analysis, interpretation and presentation of data. In this lesson you will learn about the meaning of statistics and its scope and its need in economics.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the need and scope of statistics in Economics;
- describe the importance of statistics in Economics;
- know the characteristics of statistical data;
- carry out statistical enquiry;
- identify sources of statistical data; and
- explain the functions and limitations of statistics.

5.1 NEED AND SCOPE OF STATISTICS

(a) Need for Statistical Data

Statistics plays a very important role in the field of economics. There is need of statistical data in every walk of life. No field of study is complete without the supporting quantitative information about that field. Some of the ways in which statistics is widely used in economics are as follows:

(i) **In Construction of Economic Theories:** An economic theory is first developed on the basis of what we observe in real life. It is then approved or disapproved by the analysis of statistical data relevant to the observation. For example, it is observed that consumers demand less at higher prices. This observation takes the shape of a theory when it is confirmed from actual statistical data that consumers really demand less at higher prices.

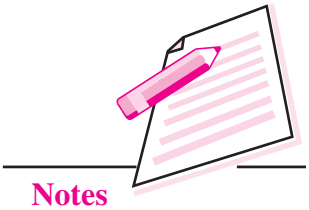
(ii) **In Economic Planning:** Statistics is an important tool of economic planning. Planners use statistical data to formulate policies for economic development. For example, India is an over populated country. However, the extent of over population can be revealed by data on population and resources available to support the population. Effective policies to control population can be framed only after we know how much over-populated India is.

(iii) **In evaluation of policies of the government:** It is not only enough to implement policies but also necessary to know whether the implementation has been proper or not. Statistical data helps us to evaluate the policies of the government. For example, how much revenue did the government get through higher taxes? It is through statistical investigations that the Finance Minister gets feedback on the taxes paid by the people and the revenue accrued to the government.

(iv) **To reveal the structure of an economy:** We study the structure of an economy with the help of data on population, natural resources, employment, national income, production, exports, imports etc. The statistical knowledge about these helps us to know about the structure of the economy and the changes in the structure of the economy.

(b) Scope of Statistics

In ancient times, statistics was used by the state for the purpose of administration. But now a days, it is widely used as a tool of all sciences. There is hardly any field whether it be biology, botany, astronomy, physics, chemistry, sociology, or psychology where statistical tools are not used. The word statistics is used in two senses: (a) the plural sense and (b) the singular sense. In a plural sense it refers to quantitative information or simply statistical data. In singular sense, it refers to



method or methods used in arriving at the quantitative information or dealing with it. We can explain the difference between the two with the help of following example:

Table 5.1: Growth of Population in India

Year	Population (in crores)
1951	36.1
1961	43.9
1971	54.8
1981	68.5
1991	84.6
2001	102.87
2011	121.01

Source: Census of 2011 Population.

The above table 5.1 records population of India in different years. Here we are referring only to the quantitative information about population. We are using the word statistics in the plural sense in this case.

When we say that population of India was estimated through the census method; that the figures are presented in the tabular form; that population of India is continuously rising and that it is rising on account of fall in death rate, we are referring to the methods of collection, presentation, interpretation of trend in data and analysis of data respectively. All these steps are statistical methods. Here we are using the word statistics in the singular sense.

Importance of Statistics in Economics

There are number of economic laws which have evolved due to statistical analysis in the field of economics, e.g. Engel's law of family expenditure, Malthus theory of population etc. Let us understand the importance of statistics keeping in view the various parts of economics.

(a) **Statistics and the study of consumption:** Every individual needs a certain number of things. He spends first on necessities, then on comforts and luxuries, which depend on his income. We discover how different groups spend their income on different items of consumption with the help of statistics.

(b) **Statistics and the study of production:** The progress of production every year can easily be measured by statistics. The comparative study of productivity of various elements of production (e.g. land, labour, capital and entrepreneurship) is also done with the help of statistics. The statistics of production are very helpful for adjustment of demand and supply.

(c) **Statistics and the study of exchange:** Production is based on national and international demand. A producer needs statistics for deciding the cost of production and selling price so that he can study competition and demand of commodity in a market. The law of price determination and cost price which are bared on the various market conditions and demand and supply can be studied with the help of statistics.

(d) **Statistics and the study of distribution:** Statistics are helpful in calculation of national income in the field of distribution statistical methods are used in solving the problem of the distribution of national income. Various problems arise due to unequal distribution of wealth and national income and are solved with the help of statistical data.

INTEXT QUESTIONS 5.1

1. Fill in the blanks with appropriate word from the brackets;

   (i) What was 'statistics' called in the ancient times .....
   (science of knowledge, science of state).

   (ii) Statistics is an important tool of .....
   (methods, economics planning).

   (iii) The word statistics in singular sense refers to statistical .....
   (method, data).

2. Which of the following refers to (quantitative/qualitative) information.

   (i) Sita's height is 5'6"., where as Meera is 5'-0".

   (ii) Sita is taller than Meera.

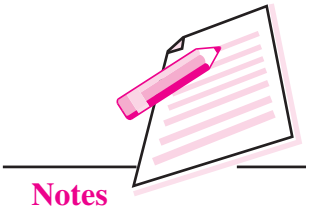
   (iii) Foodgrain production in India was estimated at 199.5 million tones in 2000-01.

   (iv) Anju is the shortest girl in her class.

5.2 MEANING OF STATISTICS

5.2.1 Statistics in plural sense

In plural sense statistics means statistical data "By statistics we mean aggregate of facts affected to a market extent by multiplicity of causes numerically expressed enumerate or estimated according to a reasonable standard of accuracy, collected



in a systematic manner for a predetermined purpose and plural in relations to each other''

In plural sense, facts expressed numerically are called statistics such as data relating to income, production, population, prices etc. In other words, statistics mean numerical statement of facts. How do the statistical data look like? Table 5.1 is an example of statistical data.

It gives information about population of India.

Here we are referring only to the quantitative information about population. We are using the word statistics in the plural sense in this case.

5.2.1.1 Characteristics of Statistical Data

(i) Statistical data are aggregates of facts: A single observation is not statistics, it is a group of observations. For example, Ram scored 60 marks out of 100 is not statistics, but a series relating to the marks of a group of students will be termed as statistics. For example, when we say that Mohan, Ram, Mary and Karim scored 35, 60, 75 and 58 marks respectively, the group of figures become statistics. Now we can compare, analyse and draw some conclusions from these figures.

For example:

1. Highest marks obtained are 75.
2. Lowest marks obtained are 35.
3. Marks range between 35 and 75.
4. Average marks obtained = $\frac{35+60+75+58}{4}$ = 57 marks

(ii) Statistics are affected by multiplicity of causes : Generally the facts and figures are affected by a number of factors working together. For example, the production of rice depends on rainfall, method of cultivation, seeds, manure, soil fertility etc. but it is very difficult to study separately the effect of each of these factors on the production of rice.

(iii) Statistical data are numerically expressed : All statistics are numerically expressed. Qualitative statements such as 'the population of India is increasing rapidly' or 'India's per capita income is low' are not statistics unless they are assigned numerical values.

Notes

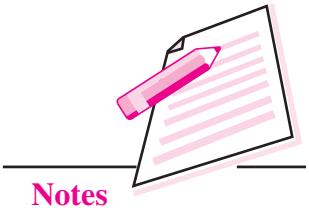
(iv) Collected in a systematic manner : Statistics should be collected systematically in a planned way. Before collecting data, a suitable plan for their collection should be prepared. Data collected in an unsystematic manner would lead to misleading conclusions.

(v) Statistical data must be obtained with reasonable degree of accuracy : Statistics are numerical statements which can be obtained with accuracy if the number of observations is small. Sometimes, when actual measurement of figures is not possible in a particular field of inquiry, then method of estimation or approximation is applied. For example, if we say that there are 30 students in XI class of XYZ public school, the figure is 100 percent accurate if we apply counting method. But, on the other hand, if we say that 20,000 people are watching the cricket match, this figure can be obtained only by estimation method i.e. as an approximation. But even this estimation must have a reasonable degree of accuracy to make sense.

(iv) Statistics are collected for a predetermined purpose : The purpose of collecting data should be decided in advance. The purpose should be clearly defined. Otherwise, collected data will be of no use. Suppose, we want to compare the performance of students at secondary level of National Institute of Open Schooling in one subject or more. We must specify the subjects and the year for which comparison is being carried out before collecting data.

INTEXT QUESTIONS 5.2

1. Tick (√) the correct answers Statistical data are:
   - (i) Numerical statement of facts.
   - (ii) Qualitative information.
   - (iii) Both quantitative and qualitative information.
   - (iv) Single or isolated facts and figures
   - (v) Aggregates of facts
2. State whether the following statements are true or false.
   - (i) Statistics are numerical statements of facts.
   - (ii) Statistical data are not single or isolated figures.
   - (iii) Statistical data are qualitative data.
   - (iv) Statistics are collected for a predetermined purpose.



5.2.2 Statistics in Singular Sense

In the singular sense, statistics means science of statistics or statistical methods. If refers to techniques or methods relating to collection, classification, presentation, analysis and interpretation of quantitative data. These are the stages through which every statistical enquiry has to pass through. We shall discuss these stages one by one.

5.2.2.1 Stages of Statistical Enquiry

Studying statistics in the singular sense implies the knowledge of various stages of statistical study.

(i) **Collection of data:** Collection of data is the first step of a statistical enquiry. Statistical data are mainly classified into primary and secondary data. Primary data are data collected directly through survey, directly from first hand sources by means of surveys, observations or experimentations. These are data that has not been previously published.

Secondary data are data collected from other sources including published and online resources. For example, Reserve Bank of India Bulletin and National Accounts Statistics are published data i.e. Secondary data. You will read more about primary and secondary data in the next lesson.

(ii) **Organisation of Data :** Organisation of the data refers to the arrangement of data in such a form that comparison of the mass of similar data may be facilitated and further analysis may be possible. An important method of organization of data is to distribute data into different classes or sub-classes on the basis of their characteristics. This process is called classification of data.

(iii) **Presentation of data :** The presentation of data means exhibition of the data in such a clear and attractive manner that these are easily understood and analysed. There are many forms of presentation of data of which the following three are well known: textual or descriptive presentation, tabular presentation and diagrammatic presentation. You will study more about this in the next lesson.

(iv) **Analysis of data :** After the data have been collected, organized and presented, they need to be analysed. Analysis of data is a technique through which significant facts from the numerical data are extracted. One of the most important objects of statistical analysis is to get one single value that describes the characteristic of the whole data. Analysis of an economic or other problems is not possible without the use of certain statistical tools such as measures of central tendency like mean, median or mode.

Notes

(v) **Interpretation of data :** Interpretation of data is the last stage of a statistical enquiry. After making analysis with the help of statistical tools, we interpret the data to derive some conclusions in order to formulate certain policies. Interpretation must be done carefully, as wrong interpretation will lead to formulation of wrong policies and hence do more harm than good.

5.3 FUNCTIONS OF STATISTICS

Main functions of statistics are given below:

(i) **Statistics simplifies complex data:** With the help of statistics a mass of data can be presented in such a manner that they become easy to understand e.g. the complex data may be presented in the form of totals, averages, percentages etc.

(ii) **Statistics presents the faits in a definite form:** By stating conclusions in a numerical or quantitative form, we can achieve definiteness.

(iii) **Statistics provides a technique of comparison:** By using statistical tools such as average ratios, percentages etc. data can be made comparable for drawing conclusion.

(iv) **Statistics studies relationship:** Correlation analysis is used to discover functional relationship between different phenomena e.g. the relationship between demand and supply, the relationship between advertisement and sales can easily be explained with the help of correlation analysis.

(v) Statistics helps in formulating policies: Many policies are framed on the basis of statistics like import, export, wage-policy etc.

(vi) Statistics helps in forecasting: The future behaviour of phenomena such as market situation for the future in predicted on the basis of available statistics of past and present.

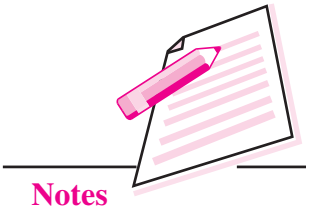
(vii) Statistics help to test and formulate theories: Statistical data and techniques are useful while testing theories e.g. whether increase in demand affects the price can be tested by collecting and comparing the relevant data.

Limitation of statistics

(i) **It does not study the qualitative aspect of a problem:** Statistics studies only the facts which can be measured quantitatively but qualitative phenomena like honesty, intelligence, poverty etc. cannot be studies in statistics unless these attributes are expressed in terms of numerals.

(ii) **It does not study individuals:** Statistics studies aggregates of facts but individual values of the observation like income of a family has no specific importance.

(iii) **Statistical laws are true only on an average:** Since the results are affected by a large number of cause, laws of statistics are not universally applicable.



(iv) **Statistics can be misused:** The results obtained with the help of statistics can be manipulated according to one's own interest which can mislead the community.

(v) **Statistical results lack mathematical accuracy:** The results drawn from statistical analysis are normally in approximations. So statistical studies are a failure in the fields where cent per cent accuracy is desired.

INTEXT QUESTIONS 5.3

1. Complete the following statements:
   (i) Statistics in plural sense means .....
   (ii) Statistics in singular sense means .....
   (iii) Statistical data are collected in a .....
   (iv) The first step in statistical enquiry is .....
   (v) The last step in statistical enquiry is .....
   (vi) Analysis of data means drawing conclusions from data with the help of .....
   (vii) Reserve Bank of India Bulletin and National Accounts Statistics are sources of ..... data.
2. Match the following:

(a) Collection of data	1. Mean, mode and median.
(b) Presentation of data	2. Primary or secondary sources.
(c) Analysis of data	3. Arriving at conclusions.
(d) Interpretation of data	4. Tables, diagrams and picture.

WHAT YOU HAVE LEARNT

- Statistics plays a very important role in economics
- Statistics is used (i) in construction of economic theories (ii) in planning (iii) in evaluation of policies of the government and (iv) to reveal the structure of an economy.
- The word statistics is used in two senses. In a plural sense, statistics refers to quantitative information or statistical data. In a singular sense it is termed as statistical methods. It means the science of collection, organization, presentation, analysis and interpretation of statistical data.

Notes

- Statistical data are (i) aggregates of facts, (ii) affected by multiplicity of causes, (iii) numerically expressed, (iv) collected in a systematic manner (v) accurate to a reasonable degree or standard, and (vi) collected for a predetermined purpose.
- A statistical enquiry passes through the stages of collection, presentation, analysis and interpretation of data.
- Sources of statistical data are primary and secondary.
- Statistical data is presented in the form of tables, graphs, diagrams and pictures.
- Statistics:
  - (i) simplifies complex data,
  - (ii) presents the faits in definite form
  - (iii) provides a technique of comparistic,
  - (iv) studies relationship,
  - (v) helps in formulating policies,
  - (vi) helps in forecasting,
  - (vii) helps to test and formulate theories.
- Limitations of statistics are:
  - (i) it does not study the qualitative aspect of a problem
  - (ii) it does not study individual
  - (iii) statistical laws are true only on an average
  - (iv) statistics can be misused
  - (v) statistical results lack mathematical accuracy.

TERMINAL EXERCISE

1. State the need of statistics in economics.
2. Describe in brief the scope of statistics.
3. Define statistics in plural and singular sense.
4. Define the term statistics in the plural sense and point out its main characteristics.
5. State briefly the various stages of a statistical enquiry.
6. What are the principal sources of data?
7. Describe any four limitations of statistics.

8. What are the limitation of statistics?
9. What is the importance of statistics in the field of business and economics?

ANSWERS TO INTEXT QUESTIONS

5.1

1. (i) Science of state
   (ii) Economic planning
   (iii) Methods
2. (i) Quantitative information
   (ii) Qualitative information
   (iii) Quantitative information
   (iv) Qualitative information

5.2

1. (i) and (v)
2. (i) True (ii) True (iii) False (iv) True

5.3

1. (i) Statistical data (ii) Statistical methods
   (iii) Systematic manner (iv) Collection of data
   (v) Interpretation of data (vi) Statistical tools
   (vii) Secondary
2. (a) 2 (b) 4 (c) 1 (d) 3

Terminal Exercise

1. Read Section 5.1 (a)
2. Read Section 5.1 (b)
3. Read Section 5.2 and 5.3
4. Read Section 5.2 (b)
5. Read Section 5.3 (b)
6. Read Section 5.3 (b) (i) 5.3 (b) (i)

Notes

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6

COLLECTION AND CLASSIFICATION OF DATA

In the previous lesson, you have learnt about the meaning and scope of statistics and its need in Economics. In this lesson you will learn about the techniques of collecting, organizing and condensing of data. These techniques are necessary for making the statistical data meaningful.

OBJECTIVES

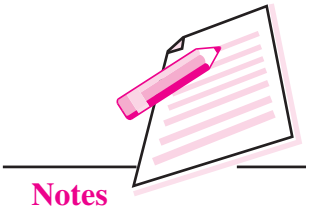
After completing this lesson, you will be able to:

- distinguish between primary and secondary data;
- list the methods of collecting primary data;
- give some examples of sources of secondary data;
- explain the concepts of an array, frequency array and frequency distribution;
- state different methods of constructing frequency distribution; and
- construct simple and cumulative frequency distributions from a given data.

6.1 COLLECTION OF DATA

(a) Primary vs. Secondary Data

Data can be collected in two different ways. One way is to collect data directly from the respondent. The person who answers the questions of the investigator is called respondent. Statistical information thus collected is called primary data and the source of such information is called primary source. This data are original because it is collected for the first time by the investigator himself. For example, if the investigator collects the information about the salaries of National Institute of



Open Schooling employees by approaching them, then it is primary data for him.

Another way is to adopt the data already collected by someone else. The investigator only adopts the data. Statistical information thus obtained is called secondary data. The source of such information is called secondary source. For example, if the investigator collects the information about the salaries of employees of National Institute of Open Schooling from the salary register maintained by its accounts branch, then it is secondary data for him.

(b) Methods for collecting primary data

There are several methods for collecting primary data. Some of which are:

1. **Direct personal interview :** In this method investigator (also called interviewer) has to be face-to-face with the person from whom he wants information. The person from whom this information is collected to called respondent.
2. **Indirect oral investigation :** Under this method data are collected through indirect sources. Under this method questions relating to the inquiry are put to different persons and their answers are recorded. This method is most suitable when the person from whom the information is sought is either unavailable or unwilling.
3. **Questionnaire method :** In this method a list of questions called questionnaire is prepared and sent to respondents either through post or given personally to them. This method is suitable where the field of inquiry is wide.

   There are some advantages of using primary data. The investigator can collect the data according to his requirement. It is reliable and sufficient for the purpose of investigation. However, it suffers from disadvantages also in that it involves a lot of cost in terms of money, time and energy. This make unsuitable when field of enquiry is very very large. Many a times with some modifications, same purpose may be served by using data collected by other persons or agencies.

(c) Sources of secondary data

As already discussed secondary data are not collected by the investigator himself but they are obtained by him from other source. Broadly, there area two sources: (a) Published data and (b) Unpublished data.

I. Published Sources

There are certain agencies which collect the data and publish them in the form of either regular journals or reports. These agencies/sources are known as published sources of data.

In India some of the published sources are:

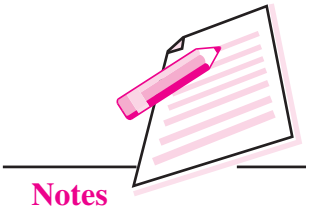
1. **Central Statistical Organisation (CSO) :** It publishes data on national income, savings, capital formation etc., in a publication called National Accounts Statistics.
2. **National Sample Survey Organisation (NSSO) :** This organization which is under the Ministry of Finance provides data on all aspects of national economy, such as agriculture, industry, employment and poverty etc.
3. **Reserve Bank of India (RBI) :** It publishes financial statistics. Its publications are Report on Currency and Finance, Reserve Bank of India Bulletin and Statistical Tables Relating to Banks in India etc.
4. **Labour Bureau :** Its publications are Indian Labour Statistics, Indian Labour Year Book and Indian Labour Journal.
5. **Population Census :** It is undertaken by the office of the Registrar General, Census of India, Ministry of Home Affairs. It provides us statistics on population, per capita income, literacy rate etc.
6. **Papers and Magazines :** Journals like 'Capital', 'Commerce', Economic and Political Weekly', and newspapers likes 'The Economic Times' etc. also publish important statistical data.

II. Unpublished Sources

Secondary data are also available from unpublished sources, because all statistical data is not always published. For example, information recorded in various government and private offices, studies made by research scholars etc. can be important sources of secondary data.

INTEXT QUESTION 6.1

1. Fill in the blanks with suitable words given in brackets against each:
   (a) ..... data are original. (Primary, Secondary)
   (b) ..... Primary data are collected by the ..... himself. (respondent, vestigator)
   (c) CSO publishes data on ..... (national income, population)
2. State whether the following statements are true or false:
   (a) Secondary data are collected by the investigator himself.
   (b) Reserve Bank of India Bulletin represents an unpublished source of data.
   (c) A person from whom an investigator tries to get information is called respondent.



6.2 ORGANISING AND CONDENSING DATA

Suppose a statistical investigator wants to analyse the marks obtained by 40 students in a class. He collects data and finds that marks obtained by 40 students in the class are:

20	25	28	27	34	31	30	32	33	40
43	43	40	43	42	43	42	45	43	47
48	46	47	48	46	49	58	54	56	50
53	51	39	38	36	38	35	35	37	

Put yourself in the position of investigator. In which aspect of this data you will be interested? Perhaps you would be interested in knowing the highest marks obtained by any student. You may also be interested to know the lowest marks obtained by a student. Another point of interest can be the marks level around which most of the students have obtained.

The above data are unorganized. To refine this data for comparison and analysis it should be arranged in an orderly sequence or into groups on the basis of some similarity. This whole process of arranging and grouping the data into some meaningful arrangement is a first step towards analysis of data. Data can be arranged in two forms: (a) Arrays and (b) Frequency distributions.

(a) Arrays

A method of presenting an individual series is a simple array of data. An orderly arrangement of raw data is called 'Array'. Arrays are of two types: (i) Simple array, and (ii) Frequency array.

(i) **Simple Array :** A simple array is an arrangement of data in ascending or descending order. Let us construct the simple arrays of the data about the marks of 40 students. The data in table 6.1 is arranged in ascending order and in table 6.2 in descending order.

Table 6.1: Ascending Array of the Marks obtained by 40 students in class

20	35	42	47
25	36	43	48
27	37	43	48
28	38	43	49
30	38	43	50

31	39	43	51
32	40	45	53
33	40	46	54
34	40	46	56
35	42	47	58

Table 6.2: Descending Array of the Marks obtained by 40 students in class

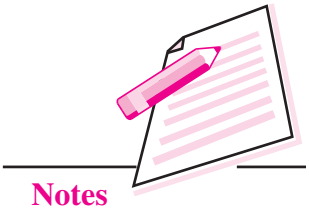
58	47	42	35
56	46	40	34
54	46	40	33
53	45	40	32
51	43	39	31
50	43	38	30
49	43	38	28
48	43	37	27
48	43	36	26
47	42	35	20

The above arrays reveal information on two points clearly. One, the highest marks obtained by any student are 58. Two, the lowest marks obtained by any student are 20.

Organising the data in the form of simple array is convenient if number of items is small. As the number of items increase the series becomes too long and unmanageable. As such there is need to condense data. Making a frequency array is one method of condensing data.

(ii) Frequency Array : Frequency array is a series formed on the basis of frequency with which each item is repeated in series. The main steps in constructing frequency array are:

1. Prepare a table with three columns-first for values of items, second for tally sheet and third for corresponding frequency. Frequency means the number of times a value appears in a series. For example in table 6.1 the marks 43 appears five times. So frequency of 43 is 5.



2. Put the items in first column in a ascending order in such a way that one item is reordered once only.
3. Prepare the tally sheet in second column marking one bar for one item. Make blocks of five tally bars to avoid mistake in counting. Note that every fifth bar is shown by crossing the previous four bars like e.g., ////.
4. Count the tally bars and record the total number in third column. This column will represent the frequencies of corresponding items.

Let us now explain construction of frequency array of the marks obtained by 40 students. In table 6.3 data about the marks is arranged in an ascending order in first column. It helps to find not only the maximum and minimum values but also makes it easy to draw bars.

Now for each mark level make one bar (/) in second column and cross the item from the data.

Table 6.3 Frequency array of marks obtained by 40 students

Marks(X)	Tally Sheet	Frequency
20	/	1
25	/	1
27	/	1
28	/	1
30	/	1
31	/	1
32	/	1
33	/	1
34	/	1
35	//	2
36	/	1
37	/	1
38	//	2
39	/	1
40	///	3
41	//	2
42	//	2
43	𝍸	5
45	/	1

46	//	2
47	//	2
48	/	1
49	/	1
50	/	1
51	/	1
53	/	1
54	/	1
56	/	1
58	/	1
		Total Frequency = 40

The main limitations of frequency array is that it does not give the idea of the characteristics of a group. For example it does not tell us that how many students have obtained marks between 40 and 45. Therefore it is not possible to compare characteristics of different groups. This limitation is removed by frequency distribution.

INTEXT QUESTIONS 6.2

Fill in the blanks with appropriate word from the brackets:

(a) A simple array is an arrangements of data in ..... (only ascending order, only descending order, either ascending or descending order).

(b) Organising data in simple array is convenient if number of items are ..... (large, small).

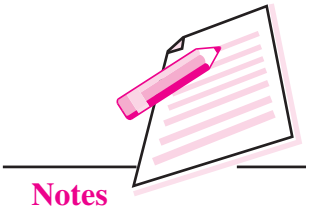
(c) Arranging the data in the form of ..... array is more convenient if number of items are large. (simple, frequency).

(d) Frequency array ..... the idea of characteristics of a group. (gives, does not give)

6.3 FREQUENCY DISTRIBUTION

Data in a frequency array is ungrouped data. To group the data we need to make a 'frequency distribution'. A frequency distribution classifies the data into groups. For example, it tells us how many students have secured marks between 40 and 45.

Before constructing frequency distribution, it is necessary to learn the following important concepts (see tables 6.4 and 6.5) :



1. **Class :** Class is a group of magnitudes having two ends called class limits. For example, 20-25, 25-30 etc. or 20-24, 25-29 etc. as the case may be, each represents a class.
2. **Class Limits :** Every class has two boundaries or limits called lower limit (L_1) and upper limit (L_2). For example in the class (20-30) $L_1 = 20$ and $L_2 = 30$.
3. **Class Interval :** The difference between two limits of a class is called class interval. It is equal to upper limit minus lower limit. It is also called class width. Class interval = $L_2 - L_1$. For $30 - 20 = 10$.
4. **Class Frequency :** Total number of items falling in a class that is having the value within L_1 and L_2 is class frequency. For example in table 6.4 class frequency in class (40-45) is 10. Similarly in class (50-55) the frequency is 4.
5. **Mid-Point/Mid-Value(M.V.) :** The mid-value of the class interval of a class also called as mid-point is obtained by dividing the sum of lower limit and upper limit of the class by 2. It is the average value of two limits of a class. It falls just in the middle of a class is

$$\text{M.V.} = \frac{L_1 + L_2}{2}$$

For example, the mid-value of class (20-30) is $\frac{20+30}{2} = 25$

Construction of Frequency Distribution

Frequency distributions can be constructed in many ways. We will explain here the construction of the following types:

(a) Exclusive series

(b) Inclusive series

(c) Open end classes

(d) Cumulative frequency

While constructing a frequency distribution same steps are to be taken which we have followed in the frequency array. The only difference is that we record classes like (20-25), (25-30), (30-35)….(55-60) etc., in first column in place of absolute items like 20, 25,..56,58 etc.

(a) Exclusive series: In this type one of the class limits (generally upper limit L_2) is excluded while making a tally sheet. Any item having the value equal to the upper limit of a class is counted in the next class. For example, in a class of (20-25) all items having the value of 20 and more but less than 25 will be counted in this class.

Notes

Item having the value of 25 will be counted in next class of (25-30) as is clear from the following example, Using the same data as given in making a frequency array and taking class interval of 5, a frequency distribution of exclusive type will be as under:

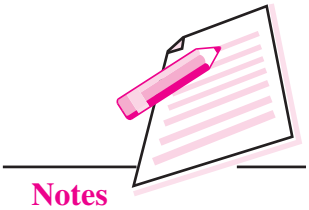
Table 6.4: Construction of Frequency Distribution – "Exclusive Type"

Class	Tally Sheet (Tallies)	Frequency (f)
20-25	/	1
25-30	///	3
30-35	𝍸	5
35-40	𝍸 //	7
40-45	𝍸 𝍸	10
45-50	𝍸 ///	8
50-55	////	4
55-60	//	2
		Total Frequency = 40

(b) Inclusive Series : In this type the lower limit of next class is increased by one over the upper limit of previous class. Both the items having value equal to lower and upper limit of a class are counted or included in the same class. That is why such a frequency distribution is called inclusive type. For example in the class (20-24) both 20 and 24 will be included in the same class. Similarly in the class (40-44) both 40 and 44 will be included. The following table has been formed on the basis of same data as taken in the exclusive type.

Table 6.5: Construction of Frequency Distribution – "Inclusive Type"

Class	Tally Sheet (Tallies)	Frequency (f)
20-24	/	1
25-29	///	3
30-34	𝍸	5
35-39	𝍸 //	7
40-44	𝍸 𝍸	10
45-49	𝍸 ///	8
50-54	𝍸	4
55-59	//	2
		Total Frequency = 40



(c) Open-end Classes : Open-end frequency distribution is one which has at least one of its ends open. You will observe that either lower limit of first class or upper limit of last class or both are not given in such series. In table 6.6 the first class and the last class i.e. below 25 and 55 and above are open-end classes.

Table 6.6: Open-end Classes Frequency Distribution

Class	Tally Sheet	Frequency (f)
Below-25	/	1
25-30	///	3
30-35	𝍸	5
35-40	𝍸 //	7
40-45	𝍸 𝍸	10
45-50	𝍸 ///	8
50-55	////	4
55 and above	//	2
		Total Frequency = 40

(d) Unequal Classes : In case of unequal classes frequency distribution, the width of different classes (i.e. L_2-L_1) need not be the same. In table 6.7, the class (30 – 40 has width 10 while the class (40-55) has width 15.

Table 6.7: Unequal Classes Frequency Distribution

Class	Tally Sheet	Frequency (f)
20-25	/	1
25-30	///	3
30-40	𝍸 𝍸 //	12
40-55	𝍸 𝍸 𝍸 𝍸 //	22
55-60	//	2
		Total Frequency = 40

(e) Cumulative Frequency : A 'Cumulative Frequency Distribution' is formed by taking successive totals of given frequencies. This can be done in two ways:

(i) From above, such as 1,4 (i.e. 1+3), 9(i.e. 4+5), 16 (i.e. 9+7), and so on.

Notes

Such a distribution is called 'Less-than' culmulative frequency distribution. It shows the total numbers of observations (frequencies) having less than a particular value of the variable (here marks). For example, there are 4 (i.e. 1+3) students who got marks less than 30; 9 (i.e. 4+5) students who got marks less than 35 and so on. Table 6.8 gives the less-than cumulative frequency distribution.

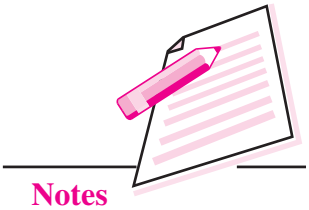
Table 6.8: 'Less-than' Cumulative Frequency Distribution

Marks	Cumulative Frequency (cf)
Less than 25	1
Less than 30	4 (1+3)
Less than 35	9 (4+5)
Less than 40	16 (9+7)
Less than 45	26 (16+10)
Less than 50	34 (26+8)
Less than 55	38 (34+4)
Less than 60	40 (38+2)

(ii) From below, such as 2,6 (i.e. 2 + 4), 14 (i.e. 6+8), 24 (i.e. 14 + 10) and so on. Such a distribution is called 'More-than' cumulative frequency distribution. It shows the total number of observations (frequencies) having more than a particular value of the variable (here marks). For example there are 6 (i.e. 2 + 4) students who got marks more than 50, 14 (i.e. 2 + 4 + 8) students who got marks more than 45 etc. See table 6.9.

Table 6.9: 'More-than' Cumulative Frequency Distribution

Marks	Cumulative Frequency (cf)
More than 20	40
More than 25	39 (40-1)
More than 30	36 (39-3)
More than35	31 (36-5)
More than 40	24 (31-7)
More than 45	14 (24-10)
More than 50	6 (14-8)
More than 55	2 (6-4)



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INTEXT QUESTIONS 6.3

Fill in the blanks with appropriate word from the brackets.

(a) Frequency distribution ..... data into groups.
(classifies, does not classify)

(b) The difference between two limits of a class is called .....
(Class limit, class interval).

(c) In the exclusive type frequency distribution an item having value equal to the upper limit is counted in the ..... class. (same, next)

(d) In the inclusive type frequency distribution an item having value equal to the upper limit is counted in the ..... class.

(e) Preparing a frequency distribution by taking 'successive totals' of frequencies is called ..... frequency distribution. (open-ended, cumulative)

ACTIVITY

1. Visit children in your neighbourhood and record the age of at least 30 of them and then construct a frequency distribution of both exclusive as well as inclusive types.
2. From daily newspapers, record maximum temperature of your city for 30 days. Prepare at frequency distribution of both exclusive as well as inclusive types with a class interval of 1.5 degrees Celsius and with at least 5 classes.

WHAT YOU HAVE LEARNT

- For any statistical enquiry, data can be collected in two ways:

  (a) either by the investigator himself. This is called primary data.

  (b) or he can obtain it from other sources i.e. data already collected by others. This is called secondary data.

- In India there are several sources of getting secondary data. Some of these are: Central Statistical Organisation (CSO), National Sample Survey Organsation, (NSSO), Reserve Bank of India (RBI), etc.
- Collected data are normally in a disorderly form. Therefore, they have to be arranged in some orderly form or sequence. This is called arrangement of data.
- The various ways of arrangement of data are: a simple array, a frequency array

Notes

and frequency distribution. Arrays can be (i) simple array or (ii) frequency array.

- When simple frequencies are successively totaled, we get what is called cumulative frequency distribution.
- To get frequency distribution we have to make use of tally sheet.
- Formation of frequency distribution requires important decisions regarding number of classes, class limits and class width etc.
- A class is a group of magnitudes having two ends called class limits (L_1 and L_2), L_1 being lower limit and L_2 the upper limit.
- Total number of cases falling in a particular class is called class frequency.
- We can form the following types of frequency distributions:
  - (a) exclusive type where the upper limit of the class is excluded and put in the next class.
  - (b) inclusive type where the upper limit of the class is included in the same class.
  - (c) Open-end like (below 25) and (55 and above).
  - (d) Unequal classes where class width or class interval of different classes is different like (20 – 25), (25-30), (30-40)….
  - (e) Cumulative 'Less-than' and 'More-than' where simple frequencies are successively totaled from above and from below respectively.

Cumulative: means successive totaling. That is, something increasing in quantity by one addition after another.

Condensation: putting huge quantity of data in some useful, short or brief form without losing its utility.

Respondent: is a person who responds or answers to some questions raised. When an investigator approaches a person with a questionnaire, the person who answers these questions is called respondent.

Sequence: in ordinary language means connected line of events or ideas. In statistics it means a series formed on some such principle e.g. sequence of numbers from, say 2, with a difference of say, 5 That is 2, 7, 12, 17, 22 etc. These numbers are in ascending order of sequences. If we put them in the form (reverse sequence) …….. 22, 17, 12, 7, 2, these are called in descending order of sequence.

Tally Sheet: is a statement where occurrence of each value of a series is recorded by making one bar. (/)

Data: means statistical information on population, employment, prices, exports, imports etc. that has been collected, analysed and published by government departments, commercial and industrial associations, and other research agencies.

TERMINAL EXERCISE

1. Distinguish between primary and secondary data. Describe the methods for collecting primary data.
2. What is secondary data? Name some of its sources in India.
3. Distribution between simple array and frequency array with examples.
4. On the basis of the following data about the wages of 20 workers in a factory, prepare a frequency array; 450, 580,600, 480, 540, 620, 400, 475, 500, 480, 620, 480, 570, 600, 650, 410, 550, 600, 650, 450.
5. Explain the concept of 'frequency distribution'. How is it different from 'frequency array.?
6. On the basis of data in question 4, prepare a frequency distribution by exclusive method.
7. Distinguish between 'exclusive method' and 'inclusive method' of frequency distribution with examples.
8. Write short notes on:
   (a) Open-end frequency distribution.
   (b) Frequency distribution with unequal classes.
   (c) Cumulative frequency distribution.

ANSWERS TO INTEXT QUESTIONS

6.1

1. (a) Primary (b) Investigator (c) National income
2. (a) False (b) False (c) True

6.2

(a) either ascending or descending order (b) small
(c) frequency (d) does not give

6.3

(a) classifies (b) class interval
(c) next (d) same
(e) cumulative.

Notes

Terminal Exercise

1. Read section 6.1(a) and (b)
2. Read section 6.1 (a) and (c)
3. Read section 6.2(a)

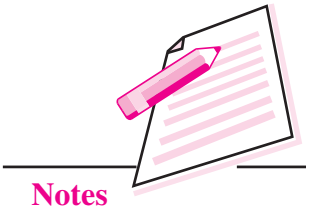
(i) Arrange the data in ascending order:

400	480	550	600
410	480	570	620
450	480	580	620
450	500	600	650
475	540	600	650

(ii) Prepare a tally sheet.

Income (₹.)	Tallies	Frequency (f)
400	/	1
410	/	1
450	//	2
475	/	1
480	///	3
500	/	1
540	/	1
550	/	1
570	/	1
580	/	1
600	///	3
620	//	2
650	//	2
		Total Frequency = 20

5. Read section 6.2 and 6.3



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6. First two steps have already been explained in answer to question 4. The third step is as follows.

Income groups (Rs.)	Frequency (f)
400-450	2
450-500	6
500-550	2
550-600	3
600-650	5
650-700	2
	Total Frequency = 20

7. Read section 6.3 (a) and (b)

8. (a) Read section 6.3 (c)

   (b) Read section 6.3 (d)

   (c) Read section 6.3 (e)

Notes

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7

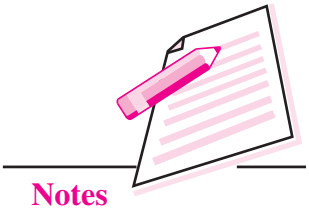
PRESENTATION OF DATA

In the previous lesson, you have learnt about the methods of organizing and condensing data in the form of arrays and frequency distributions. It is the first step towards analysis of data. Another step in this direction is presentation of data to highlight and compare significant statistical facts. Statistical data can be systematically organized and presented in the form of tables, graphs and charts. There are various types of graphs. In this lesson, you will learn about table, bar charts, pie diagram (or chart) and time series line graph.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning and purpose of a table;
- distinguish between reference table and special purpose table;
- draw the format of a table;
- explain the meaning and construction of simple and multiple bar charts;
- explain the need and construction of component bar charts;
- explain the meaning of pie chart and steps in its construction;
- explain the meaning of a time series graph and steps in its construction; and
- construct histogram, frequency polygon and cummutative frequency curve (OGIVE).



7.1 TABLE

(a) Meaning

A table is a systematic arrangement of related statistical data in columns and rows with some predetermined aim or purpose. Can you arrange the following information in tabular form?

"There are 50 Science, 50 Commerce and 50 Arts students in a college. The number of students from poor families is same for each course and their total is 30. Whereas science and commerce courses are equally popular in rich families, yet the number of rich arts students is twice as much. In all 40 students are from the rich families studying in the college. The majority of students are from middle class families and their number is 80."

Let us arrange this information in tabular form. There are 150 students in all. A table leaves a more lasting impression on human mind than statements saying the same thing. As they say, a picture is worth 1000 words.

Table 7.1: Distribution of students according to course and economic status

	Science	Arts	Commerce	Total
Rich	10	20	10	40
Middle Class	30	20	30	80
Poor	10	10	10	30
Total	50	50	50	150

(b) Purpose

The purpose of a table is to simplify presentation of related data and make comparisons easy. The reader can easily locate the desired information. For example, the purpose of table 7.2 might be to show the imports and exports of country 'A' vis-à-vis other countries B, C, D and E.

Table 7.2: Imports and Exports of Country 'A' during 2002-05 (₹. Crores)

	Country	Imports	Exports
1	B	70	73
2	C	72	80
3	D	74	85
4	E	85	80

Notes

From the table 7.2 on exports and imports, we can easily locate the country which has highest exports. The data given in rows is read from left to right. For example, row 1 shows that country A imports 70 from B and exports 73 to B. The data given in column B read from above to downwards. For example, column 2 shows that country A imports 70, 72, 74, 85 respectively from countries B,C,D and E.

(c) Types of Tables

Basically we have two types of tables (i) Reference or general purpose tables or (ii) special purpose or text tables. Let us discuss them one by one.

(i) **Reference or general purpose tables:** These tables are in a way a store of information with an aim of presenting detailed statistical data. From these tables we can derive smaller tables. Generally, statistical tables presented by Government of India and its various statistical agencies and departments are reference or general purpose tables.

(ii) **Special purpose or test tables:** These tables are smaller and can be obtained from reference tables. They aim to analyse a particular aspect so that we are able to bring out a specific point or answer a specific question.

(d) Parts of Table

Parts (or elements) of a table vary from table to table depending upon the nature of data and purpose of a table. However, some points are common to all (see format of table 7.3). They are:

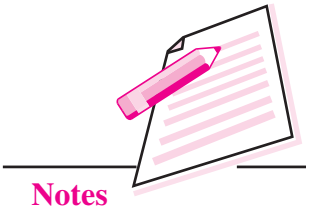
Table 7.3: (..... Title .....) (in ₹. Crores)

Stub Head	Column Head 1		Column Head 2	
	Sub Column head	Sub column head	Sub column head	Sub column head
Stub Entries	Main Body of the Table (field)			

Footnote (.....)

Source of data (.....)

1. **Table Numbers:** If more than one table has been used or presented at one place, it is always better to give them numbers. It makes further reference to them easy. This number is always indicated in the top for example Table 7-1, Table 7-2 etc.
2. **Title:** Title is to the table what heading is to an essay. It appears at the top of a table and gives idea about what is contained in the main body of the table. The title should be brief and to the point. It is better if the title is presented in bold letters or capital letters. What is the title of Table 7-2?



3. **Head note (or prefatory note):** It is written below the title. It clarifies the contents of the table and unit of measurements like "in rupees crores" or "in lakh tons" or "in thousand bales of cotton" etc. It must be written in brackets on right side (top) of the table immediately below the title. For example, in table 7.2 the unit of measurement is rupees crores.
4. **Stub:** The stub consists of stub head and stub entries. Whereas stub describes the stub entries down below it, each stub entry labels a given data placed in its row. Both stub head and stub entries appear on the left hand column of the table. Further, stub entries describe the column heads.
5. **Main Body or Field:** It is the most important part of the table and contains the numerical information about which a hint is given in title. For example, if the title is "Exports and Imports of Country A during 1995-96, it clearly shows that the body of the table contains statistical/numerical information on value of exports and imports of country A with different countries.
6. **Footnote:** It is a qualifying statement placed at the bottom of a table. Its purpose is to explain omission or limitations of the data presented in main body of the table. For example, if the data for a year is not available then it is mentioned at the bottom of the table.
7. **Source of Data:** Last but not the least, it is essential to mention the source of data presented in the table. It helps the reader to check the original source of data himself and get more of it on the subject. This also makes the data presented in the table more reliable. It should mention information like title, edition, page number and source of publication etc.

INTEXT QUESTION 7.1

1. State whether the following statements are true or false:
   (a) Satisfactory collection of data must be followed by its good presentation.
   (b) Tabulation is the only way of presenting data.
   (c) Tables help in intelligent use of statistical data.
   (d) The title of a table should be brief and to the point.
2. Fill in the blanks using suitable word given in the bracket.
   (a) A ..... is a systematic arrangement of statistical data in columns and rows. (table, graph)
   (b) Head note is written below the ..... of the table. (title, footnote)
   (c) The ..... consists of stub head and stub entries. (stub, note)
   (d) A foot-note is placed at the ..... of a table. (top, main body, bottom)

7.2 BAR CHARTS OR DIAGRAMS

Meaning

A bar can be defined as a thick 'line', often made thicker to draw attention of the reader. The height of this bar shows the quantity of the variable we want to present. It is also called one dimensional diagram because only height of the bar is important and its base or width is not taken into account. To make them look more beautiful, bars are either coloured or shaded in different ways.

Types of bar charts:

There are two types of bar charts (a) simple and (b) components.

(a) Simple bar charts

Simple bar charts can be (i) Single bar charts, and (ii) Multiple bar charts.

(i) **Single bar charts:** We can either have vertical bars (figure 7.1) or horizontal bars (figure 7.2). Normally vertical bars are often used. Let us now explain how a bar diagram can be prepared from given data in table 7.4.

Table 7.4: Number of cars registered in three States

States	No. of Cars
A	8,000
B	10,000
C	4,000

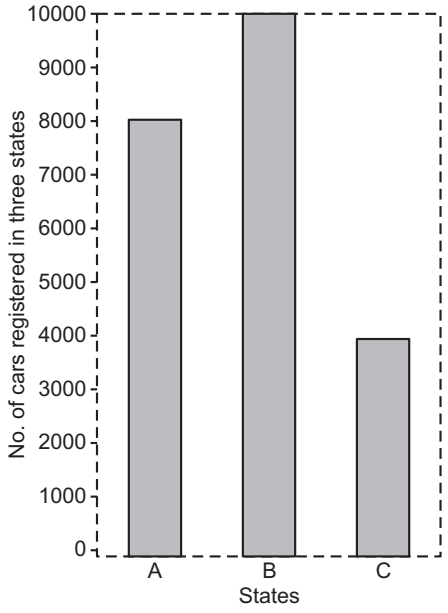
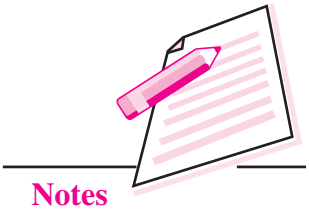


Fig. 7.1: Cars registered in states



In the case of vertical bars. States are represented on X axis and number of cars on the Y axis. As per the data given in table 7.4 each bar (rectangle with same base) is raised accordingly to the value of the variable (here the number of cars registered). For example, rectangle representing State A is raised upto 8,000, for State B upto 10,000 and for State C upto 4,000 (see Fig. 7.1).

In case we prefer to use horizontal bars, we represent States on Y-axis. Here the bars (rectangles) are drawn horizontally upto 8,000, 10,000 and 4,000 cars respectively for the three States A, B and C. (see figure 7.2).

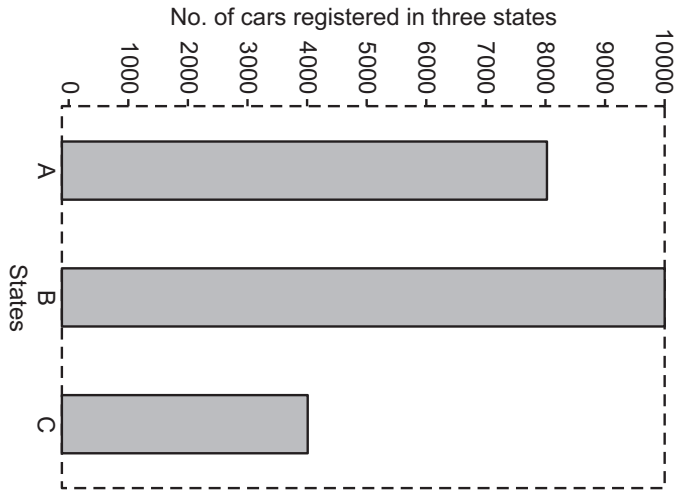


Fig. 7.2: Cars registered in states

(ii) Multiple bar charts: Sometimes it is desired to represent more than one interrelated series of data on a bar diagram. In such cases a simple bar diagram is not suitable. We have to use what is known as multiple bar diagram. Here the number of bars for each year of region or zone is equal to the number of variables (data) to be represented. For example, imports and exports will be represented by two bars; selling price, cost price and profits by three bars and so on. Normally we do not take more than three bars because it becomes complicated. The method of drawing bars is same as explained for simple bar diagrams. Two examples of multiple bar diagrams are presented below (figure-7.3 based on table 7.5 and figure 7.4 based on Table 7.6).

Table 7.5: Imports and Exports of Country 'X' during 2009 to 2013 (₹. Crores)

Year	Imports	Exports
2009-10	2955	2523
2010-11	4519	3329
2011-12	5265	4049
2012-13	5265	5143

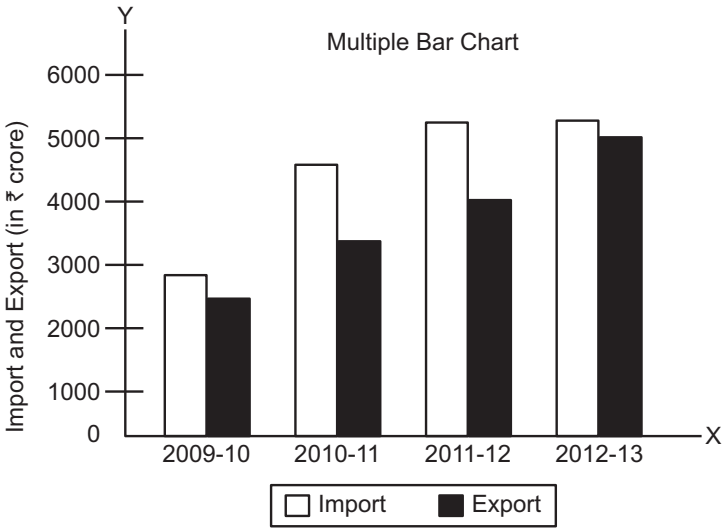


Fig. 7.3: Imports and Exports of country A during 2009-13 (in rupees Crores)

Table 7.6: Result of Class XII during 2010-2012

Year	First Division	Second Division	Third Division
2010	50	150	50
2011	60	140	70
2012	50	250	60

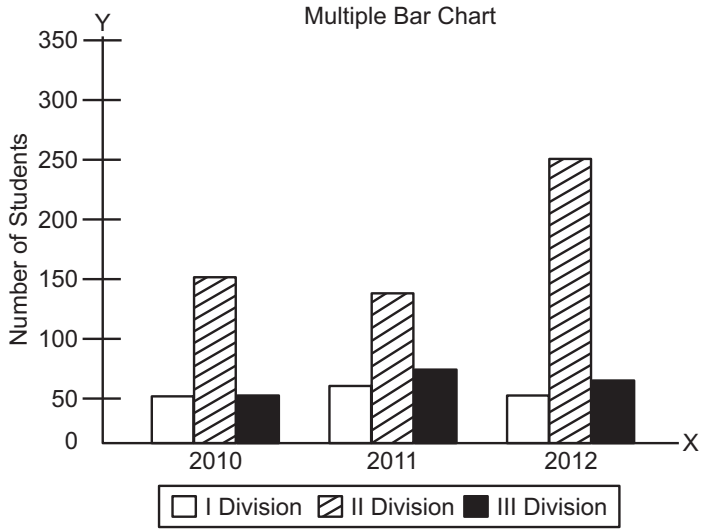
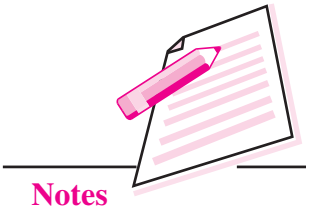


Fig. 7.4: Result of class XII during 2010-2012



(b) Component Bar Chart

A simple bar diagram explained above is used to present only one variable. But when a breakdown of total or a series of totals is to be represented, we have to use what is called sub-divided or component bar diagrams. Here we use sub-divided or component bar diagram as shown in Fig. 7.5. It is based on imaginary (or hypothetical) data shown in table 7.7.

Table 7.7: No. of students appearing in examination

Stream	University A	University B	University C
Art	8,000	6,000	3,000
Science	4,000	2,000	1,000
Commerce	7,000	5,000	4,000
Law	1,000	2,000	2,000
Total	20,000	15,000	10,000

Number of Students appearing in Examinations in Various Universities

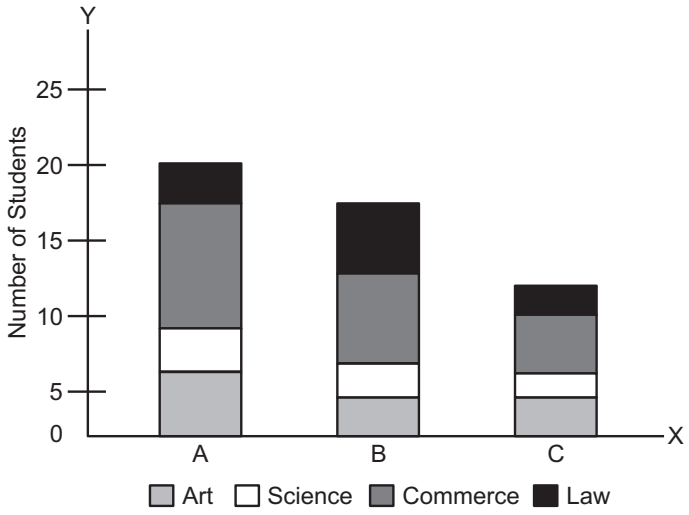


Fig. 7.5: Steps in the construction of a component bar diagram

Step 1. The order of various components in different bars should be same so as to facilitate comparison.

Step 2. The number of components in a bar, in no case should exceed 10.

Step 3. Index or key showing various components must be shown through different shades or colours

7.3 PIE DIAGRAM

Meaning

It is also known as angular diagram. Pie diagrams are more popularly used for presenting percentage breakdown of data. For example, students of a particular college may be put in three categories-Science students, Commerce students and Arts students. Or exports of India may be classified as to USA. Europe, Middle-East countries, Africa etc. The pie diagram can be effectively used to show these categories or breakdowns. A pie diagram therefore, is a circle subdivided into component sectors to present the proportion of different constituent parts to the total. As such a pie diagram is shown in percentage terms.

Steps in the construction of pie diagram

Step 1. Find the value of each category or component or group as percentage of total of all categories or components or groups.

Step 2. Calculate degree of the angle formed by each category or component or group by the formula given below.

Degree for a particular category/component/group

$$= \frac{\text{Value of the group}}{\text{Total of all groups}} \times 360^\circ$$

Step 3. Take a circle of a suitable size and draw radius.

Step 4. Now draw angles calculated in step 2 with the help of a protractor.

Step 5. Shade or colour different segments suitably or make the distinctions between different categories or components or groups.

Step 6. For each category or component or group put the percentage in the pie diagram as shown in figure 7.6.

Let us now take an imaginary example to illustrate the construction of a pie-diagram.

Example: From the monthly budget of an industrial worker of Mumbai Industrial Area, it was found that the family spent ₹. 360 on food, ₹. 108 on clothing, ₹. 90 on housing, ₹. 24 on comforts, ₹. 12 on education and entertainment and ₹. 6 on miscellaneous items. Construct a pie-diagram.

Solution: We arrange the data in tabular form given below and complete all the steps mentioned above.

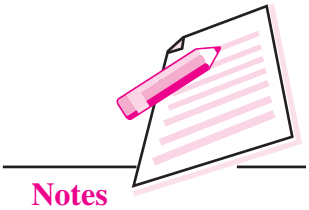


Table 7.8: Monthly Family Budget of an Industrial Worker of Bombay

Items	Expenditure	Percentage	Degree = $\frac{\text{Value of item}}{\text{Total value}} \times 360°$
Food	360	$\frac{360}{600}\times100=60$	$\frac{60}{100}\times360°=216.0°$
Clothing	108	$\frac{108}{600}\times100=18$	$\frac{108}{100}\times360°=64.8°$
Housing	60	$\frac{90}{600}\times100=15$	$\frac{15}{100}\times360°=54.0°$
Comforts	24	$\frac{24}{600}\times100=4$	$\frac{4}{100}\times360°=14.4°$
Education and Entertainment	12	$\frac{12}{600}\times100=2$	$\frac{2}{100}\times360°=7.2°$
Misc.	6	$\frac{6}{600}\times100=1$	$\frac{1}{100}\times360°=3.6°$
Total	**600**	**100**	**360°**

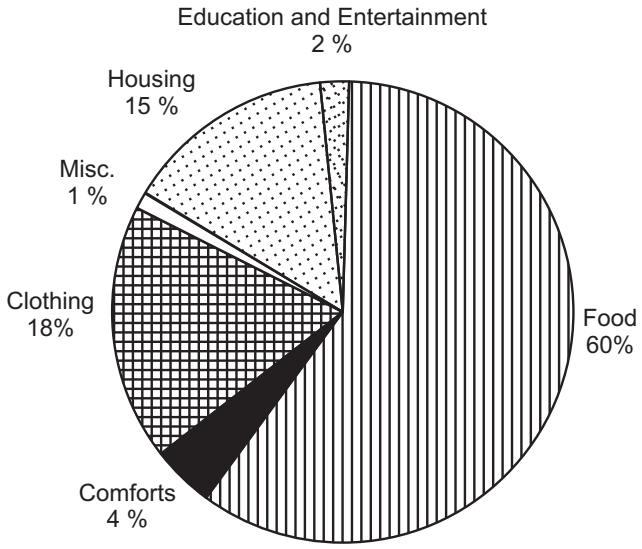


Fig. 7.6: Monthly Budget of Industrial Worker in Mumbai

INTEXT QUESTIONS 7.2

1. State whether the following statements are true or false:

   (a) The width of a one-dimensioanl bar diagram is important.

   (b) In bar diagram, height of bars shows the value of the variable.

   (c) We an have vertical as well as horizontal bars to present some data having one variable.

   (d) When a break down of data is to be represented we use multiple bar diagram.

2. Fill in the blanks with suitable word out of those given in the brackets:

   (a) A pie chart is also called ..... diagram.

   (a bar, an angular, a multiple bar)

   (b) $\frac{\text{Value of the group}}{\text{Total of all groups}} \times 360^\circ$ = ...

   (area, radius, degree for a groups).

7.4 TIME SERIES LINE GRAPH

Statistical data can also be presented in the form of line graphs. A line graph records the relationship between two variables. If one of the two variables is time in days, weeks, months or years we get a time series line graph. For example, let us draw a line graph on the basis of the following data on production of coal in country 'X' from 2009-10 to 2013-14.

Table 7.9: Production of Coal (Million Tons)

Year	Production (Million Tons)
2009-10	77.22
2010-11	78.17
2011-12	88.42
2012-13	99.80
2013-14	103.50

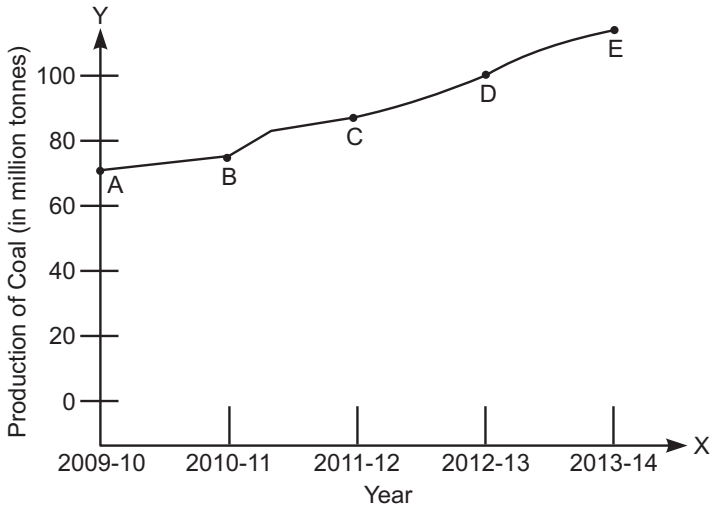


Fig. 7.7: Production of coal in country X 2009-14 (in Million Tons)

The above graph is a time series line graph. Time is represented on the X axis and production on the Y axis. Time and production are two variables in this graph. It is production which changes with time. In other words as time passes production is affected and it increases or decreases or may remain constant. Since production changes with time, it is said to be dependent on time. Production is, therefore, treated as a dependent variable. Time is not influenced by production and therefore taken as an independent variable.

Point A on the line graph (also called curve) shows that production of crude oil in country 'X' in the year 2009-10 was 77.22 million tones. Similarly points B, C and D show production levels in the subsequent years. The upward rising curve from left to right indicates that production of coal oil in Country 'X' is constantly rising since 2009-10.

It is possible to show two or more comparable dependent variables on a time series line graph. In that case each dependent variable will be recorded on a separate curve. For example, take the following data on exports and import of country 'X'.

Table 7.10: Exports and Imports of Country 'X'

Year	Imports (in ₹ 100 crores)	Exports (in ₹ 100 crores)
2009-10	15	35
2010-11	85	100
2011-12	90	70
2012-13	130	120
2013-14	170	180

The time series line graph prepared on the basis of above data is given below (see figure7.8)

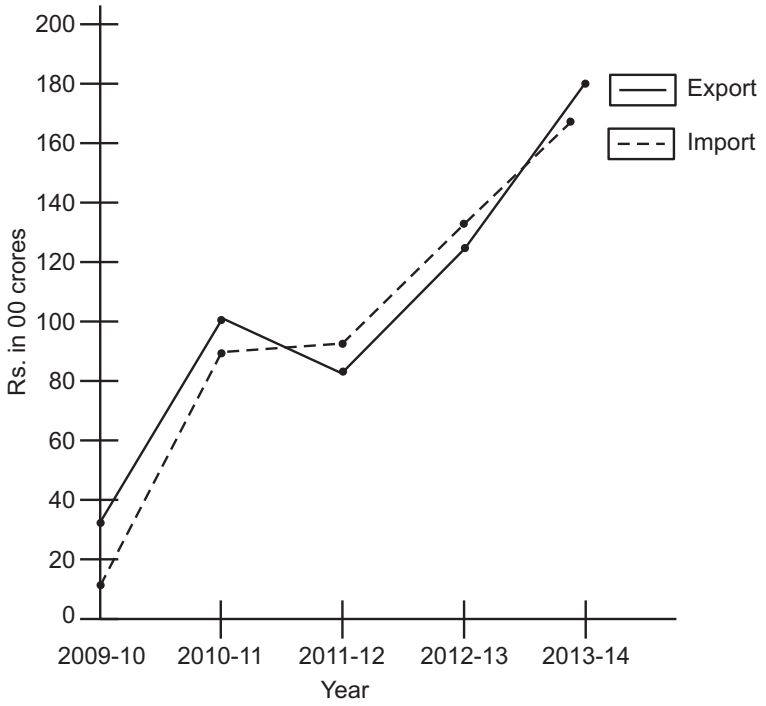


Fig. 7.8: Exports and Imports of Country X in 2009-14 (in rupees' 00 crores)

In the above graph imports are shown in broken line and exports otherwise. Such a presentation is very useful to make comparison between two dependent variables.

INTEXT QUESTIONS 7.3

Fill in the blanks:

(a) A ..... graph shows the relationship between two variables.

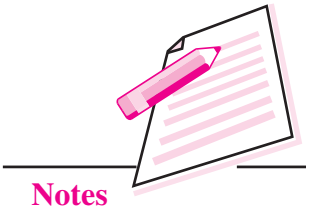
(b) If one of the variable on line graph is ..... it is called time series line graph.

(c) In a time series line graph ..... is an independent variable.

(d) In a time series line graph ..... variable is represented on the Y-axis.

7.5 HISTOGRAM

Histogram is a joining rectangular diagram of a continuous series in which each rectangle represents the class interval with frequency. It is a two dimensional diagram and also called a frequency histogram.



(i) Histogram of equal class intervals:

Example: Presents the following data in a histogram:

Marks	Frequency
0-10	2
10-20	5
20-30	8
30-40	11
40-50	10
50-60	9
60-70	4
70-80	1

Method of Construction of Histogram

(i) Take marks on x-axis.

(ii) Take frequencies on y-axis.

(iii) Get rectangle joining each other representing each class with frequency.

(iv) Label both the axis.

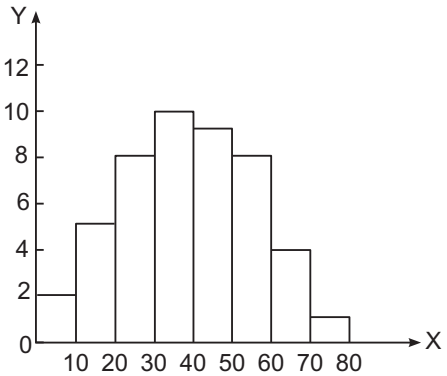


Fig. 7.9: Histogram of equal class intervals.

(ii) Histogram of unequal class intervals

Example: Represent the following data by mean of histogram:

Marks	No. of students(F)
10-15	6
15-20	19
20-25	28
25-30	15
30-40	12
40-60	12
60-80	8

Method of Construction of Histogram

(i) Since the last intervals are unequal, frequencies must be adjusted.

(ii) Take the class which has the lowest class interval.

(iii) Do not adjust the frequencies of the lowest class.

(iv) Frequencies of other classes are adjusted with this lowest class intervals.

(v) Adjusted frequencies will decide the heights of each rectangle of histogram but widths will be according to class limits.

(vi) The frequencies of minimum class intervals on which the frequencies of other classes are adjusted will not be changed.

(vii) Both axis should be clearly labelled.

The adjusted frequencies are:-

Marks	Frequency	Adjusted	Adjusted Frequency
10-15	6	–	6
15-20	19	–	19
20-25	28	–	28
25-30	15	–	15
30-40	12	$\frac{5\times12}{10}$	6
40-60	12	$\frac{5\times12}{20}$	3
60-80	8	$\frac{5\times8}{20}$	2

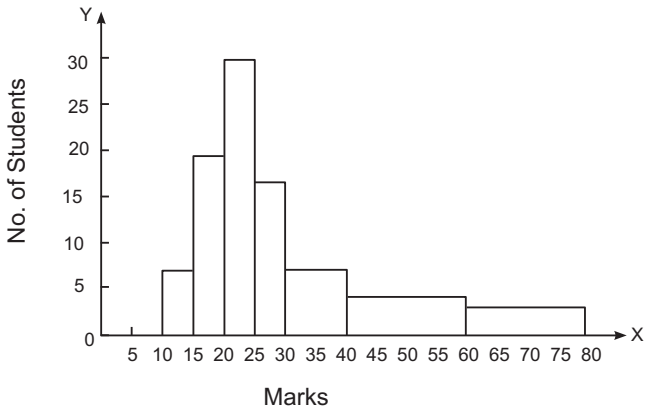


Fig. 7.10: Histogram of unequal class intervals

7.6 FREQUENCY POLYGON

Polygon is a diagrammatic presentation of data which is constructed by joining the midpoints of the tops of rectangles in a diagram. However, a polygon can be drawn even without constructing a histogram.

Example: Construct a frequency polygon from the data given below

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Students	5	10	15	20	12	8	5

Method:

(i) Draw a suitable histogram keeping in view all the basic principles.

(ii) Get the mid-points of the upper horizontal side of each rectangle.

(iii) join these mid-points of the adjacent rectangle of the histogram by straight lines.

(iv) Both axes should be clearly labelled.

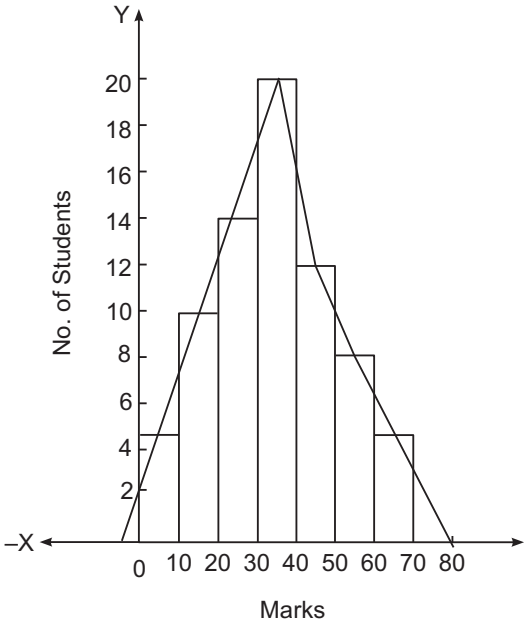


Fig. 7.11: Frequency polygon

7.7 CUMULATIVE FREQUENCY CURVE (OGIVE)

Cumulative frequency curve or ogive is the curve which is constructed by plotting cumulative frequency data on the graph paper in the form of a smooth curve.

A cumulative frequency curve or ogive may be constructed in two ways

(a) Less than, method

(b) More than method

Example: Present the following data in the form of less than ogive and more than ogive

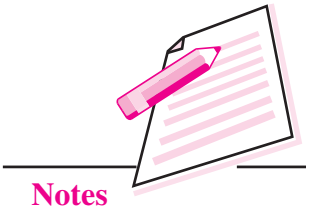
Marks	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
No. of students	4	6	10	25	22	18	5	

Method

(i) Get the cumulative frequencies of the given frequencies either by 'less than' method or by 'more than' method;

(ii) Take 'marks' (variable under study on x-axis.

(iii) Take calculated cumulative frequencies on y-axis.



(iv) Plot the various points and join them to get a curve i.e. ogive.

(v) Both the axes should be clearly labelled.

Cumulative frequency Distributive

Marks	Cumulative Frequencies	Marks	Cumulative Frequencies
less than 5	4	More than 0	100
less than 10	4 + 6 = 10	More than 5	100 – 4 = 96
less than 15	10 + 10 = 20	More than 10	96 – 6 = 90
less than 20	20 + 10 = 30	More than 15	90 – 10 = 80
less than 25	30 + 25 = 55	More than 20	80 – 10 = 70
less than 30	55 + 22 = 77	More than 25	70 – 25 = 45
less than 35	77 + 18 = 95	More than 30	45 – 22 = 23
less than 40	95 + 5 = 100	More than 35	23 – 18 = 5
		More than 40	5 – 5 = 0

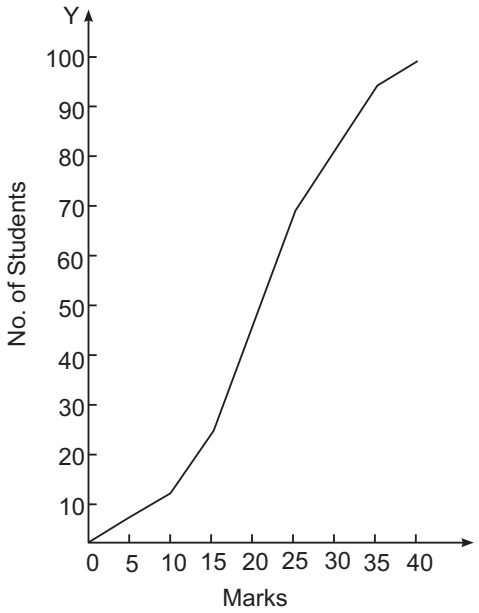


Fig. 7.12: 'Less than' ogive

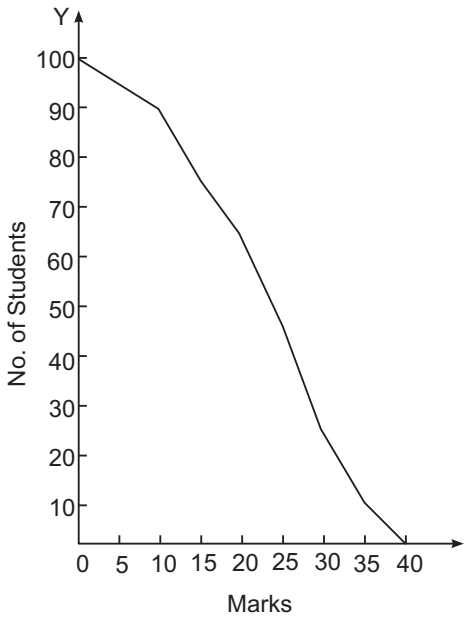
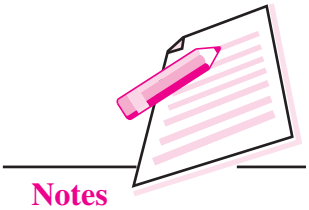


Fig. 7.13: 'More than' ogive

WHAT YOU HAVE LEARNT

- After data have been collected, they must now be arranged and presented in some useful form.
- A good presentation highlights the data and brings out important points for necessary comparison.
- Tables, frequency arrays, frequency distribution, time series line graphs etc., are some important ways in which data are presented.
- A table is a systematic presentation of data in rows and columns
- Each table has some essential constituent parts like table number, title, head note, caption, stubs, main body, foot note and source of information.
- A graph is also an important way of presenting data-such as time series line graphs, bar charts, pie diagram etc.
- A bar diagram is defined as a thick line made thicker to draw attention of the viewer.
- Its height is important as it shows the value of the variable.
    - A bar diagram can be drawn either vertically or horizontally.
    - When a breakdown of a total or a series of totals is to be shown, we use what is known as sub-divided or component bar diagram.
    - A pie diagram is also an important and effective way of presenting data. It is a circle sub-divided into components to present the proportion of different constituent parts of the total.



- When an economic variable is presented along with time, it is called a time series line graph.

TERMINAL EXERCISE

1. What is a statistical table? List its various parts.
2. What is the purpose of preparing a table? In this context distinguish between reference table and text table.
3. What is a bar chart? Explain briefly its various types.
4. What is the difference between simple bar diagram, sub-divided or component bar diagram and multiple bar diagram?
5. Explain the meaning and uses of a pie diagram. Prepare a pie diagram of family expenditure from the following data:

S.No.	Items	Expenditure (₹.)
1.	Food	480
2.	Clothing	300
3.	Education and Entertainment	330
4.	Rent	450
5.	Miscellaneous	240
	Total Expenditure	1800

6. Explain the meaning of time series line graph with the help of an example.
7. Draw a time series line graph on the basis of following data:

Annual Profits of A Firm

Year	Profit (₹. In thousand)
2009	60
2010	72
2011	75
2012	65
2013	80
2014	95

8. Make a blank table (format) showing the distribution of students of 12th class according to:

   (a) Subject group i.e. Science, Arts and Commerce

   (b) Sex i.e. boys and girls.

9. The following table gives selling price and cost price of a good 'X' for five years.

Year	2009	2010	2011	2012	2013
Selling Prices 'X'	105	110	120	90	160
Cost Price 'X'	100	80	120	120	140

Plot the above information on a graph paper in the form of line graph. What type of graph do you get?

10. Draw histogram, frequencies polygon, 'less than' ogive and 'more than' ogive from the data given below:

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	3	10	14	10	3

ANSWERS TO INTEXT QUESTIONS

7.1

1. (a) True (b) False (c) True (d) True

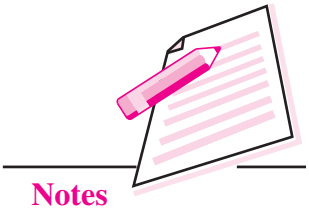
   (a) table (b) title (c) stub (d) bottom

7.2

1. (a) False (b) True (c) True (d) False
2. (a) an angular (b) degree for a component

7.3

(a) line (b) time (c) time (d) dependent



Guidelines to Activities

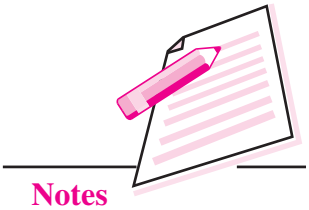
1. **Hint:**

Subject group	Number of Students		Total
	Boys	Girls	
Science			
Arts			
Commerce			
Total			

(a) Fill up yourself, the title, footnote, etc. i.e. parts of a table.

(b) Fill up the main body of the table with imaginary figures.

2. (a) Measure year of X axis and selling price (S.P.) as well as cost price (C.P.) on Y axis to get a time series line graph.



8

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MEASURES OF CENTRAL TENDENCY

In the previous lesson, we have studied how to collect the raw data, its classification and tabulation in a useful form. Yet, this is not sufficient, for practical purposes; there is a need for further condensation of the data, particularly when we want to compare two or more different distributions data set. We may reduce the entire distribution to one number which represents the distribution using the measures of central tendency.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the concept of measures of central tendency or averages;
- calculate arithmetic mean, combined arithmetic mean and weighted arithmetic mean;
- calculate median and quartiles;
- calculate mode;
- compare the various measures of central tendency; and
- apply these measures for solving various business problems.

8.1 MEANING OF CENTRAL TENDENCY

The measure of central tendency is defined as the statistical measure that identifies a single value as the representative of an entire distribution. It aims to provide an accurate description of the entire data. It is the single value that is most typical/ representative of the data. Since such typical values tend to lie centrally within a set of observations when arranged according to magnitudes, averages are called measures of central tendency. In other words, the measure of central tendency

summarizes the data in a single value in such a way that this single value can represent the entire data. The word average is commonly used in day-to-day conversations. For example, we may talk of average income of an Indian, average rainfall, average production, average price etc.

8.2 TYPES OF AVERAGES (OR) MEASURES OF CENTRAL TENDENCY

The following are the important types of averages:

- Arithmetic mean.
  - Simple arithmetic mean.
  - Weighted arithmetic mean.
- Median
- Quartiles.
- Mode.

The first one is called **'mathematical average'** where as other three are called **'measures of location'** or **'measures of position'** or **'positional averages'.**

8.2.1 Arithmetic Mean:

Arithmetic mean is the most commonly used measure of central tendency. Arithmetic mean is computed by adding all the values in the data set divided by the number of observations in it.

8.2.1.1 Computation of Arithmetic Mean in case of Individual Series

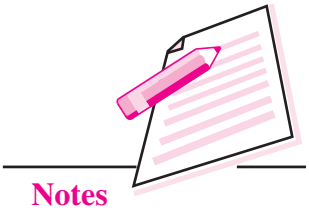
The arithmetic mean in case of individual series can be computed using following methods:

- **Direct Method**
- **Assumed Mean Method**
- **Direct Method**:

If there are N observations as $X_1, X_2 X_3 ... X_N$ then the Arithmetic Mean (usually denoted by $\bar{X}$, which is read as X bar) in case of individual series using direct method is given by:

$$\bar{X} = \frac{X_1+X_2+X_3+.... X_N}{N}$$

$$\bar{X} = \frac{\Sigma X}{N}$$



Where, ΣX = sum of all N number of observations and N = total number of observations.

Example 1: Calculate Arithmetic Mean from the data showing the marks obtained by 7 students of class XIth in certain examination 5,11,16,17,19,24,30.

The Arithmetic Mean of marks is given by:

$$\bar{X} = \frac{\Sigma X}{N}$$

$$= \frac{5+11+16+17+19+24+30}{7}$$

$$= \frac{122}{7} = 17.43 \text{ marks}$$

The average marks are 17.43.

- **Assumed Mean Method:**

Assumed mean method also called shortcut method is useful if the number of observations in the data is large and/or figures are in fraction. It helps to simplify the calculations. In this method a particular value is assumed as arithmetic mean on the basis of some logic or experience. The deviation from the said assumed mean from each of the observation is computed. The summation of these deviations is taken and then it is divided by the number of observations in the data. The actual arithmetic mean is calculated using the following formula:

$$\bar{X} = A + \frac{\Sigma d}{N}$$

Where $\bar{X}$ = Arithemetic mean, A = Assumed mean, $\Sigma d = \Sigma(X - A)$

Σd = sum of deviations, N = Number of Individual observations

Note: Any value whether existing in the data or not can be taken as the assumed mean but the final answer would be the same.

Example 2: Data of exports of a certain firms for the year 2013-2014 are mentioned in the following table:

Firms	1	2	3	4	5	6	7	8	9
Value of Exports (₹ Cr)	10	20	30	40	50	60	70	80	90

Compute average value of exports for these firms using Assumed Mean Method.

Solution:

Table 8.1: Computation of Arithmetic Mean by Assumed Mean Method

Firms	Exports(X) (in ₹Cr)	Deviation from assumed mean (A=60); d=(X-60)
1	10	-50
2	20	-40
3	30	-30
4	40	-20
5	50	-10
6	60	0
7	70	10
8	80	20
9	90	30
N = 9	ΣX = 450	Σd = –90

$$\bar{X} = A + \frac{\Sigma d}{N} = 60 + \frac{(-90)}{9} = \text{Rupees } 50 \text{ crores}$$

INTEXT QUESTIONS 8.1

1. A researcher has collected the following sample individual data.

   5 12 6 8 5 6 7 5 12 4

   The mean of the data is

   (a) 5 (b) 6 (c) 7 (d) 8

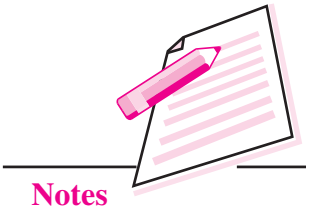
2. Find the mean of the set of numbers below:

   3, 4, –1, 22, 14, 0, 9, 18, 7, 0, 1

8.2.1.2 Computation of Arithmetic Mean for Grouped data

- **Discrete Series:**

In case of discrete series where the variable X takes the values $X_1, X_2 \ldots X_N$ with respective frequencies $f_1, f_2 \ldots f_N$ the arithmetic mean can be calculated by applying:



(i) Direct Method

(ii) Assumed Mean Method.

(iii) Step Deviation Method

(i) Direct Method: According to this method the arithmetic mean is given by:

$$\bar{X} = \frac{f_1X_1 + f_2X_2 + ...f_NX_N}{f_1 + f_2 + ...f_N} = \frac{\Sigma fX}{\Sigma f}$$

where Σf = total frequency

Example 3: The following data gives the weekly wages (in ₹) **of 20 workers in a factory:**

Weekly Earnings (in ₹)	100	140	170	200	250
No. of workers	5	2	6	4	3

Calculate the average weekly earnings of the workers.

Solution:

Table 8.2: Computation of Arithmetic Mean

Weekly Wages(X)	No. of workers(f)	fX	(A=170); d=X-170	fd
100	5	500	-70	-350
140	2	280	-30	-60
170	6	1020	0	0
200	4	800	30	120
250	3	750	80	240
	Σf=20	ΣfX=3350		Σfd=-50

Arithmetic mean using direct method, the average weekly wages are:

$$\frac{\Sigma fX}{\Sigma f} = \frac{3350}{20} = \text{Rs } 167.50$$

(ii) Assumed Mean Method: Since in the discrete series frequency (f) of each item is given, we multiply each deviation (d) from the assumed mean (A) with the respective frequency (f) to get fd. According to this method, arithmetic mean is given by:

$$\bar{X} = A + \frac{\Sigma fd}{N}$$

where A = assumed mean, d = X – A and N = Σf

Arithmetic mean using Assumed Mean Method, the average weekly earnings are:

$$\bar{X} = A + \frac{\sum fd}{N} = 170 + \frac{-50}{20} = \text{Rs.}167.50$$

(iii) Step Deviation Method: In this case the deviations taken from assumed mean are divided by the common factor 'c' which simplifies the calculation.

Here we estimate $d' = \frac{d}{c} = \frac{X - A}{c}$ in order to reduce the size of numerical figures for easier calculation. The arithmetic mean is given by:

$$\bar{X} = A + \frac{\sum fd'}{\sum f} \times c$$

Example 4: From the following data of the marks obtained by 60 students of a class.

Marks	20	30	40	50	60	70
No of students	8	12	20	10	6	4

Calculate the arithmetic mean by

(i) Direct Method

(ii) Assumed Mean Method

(iii) Step-Deviation Method

Solution:

Table 8.3: Calculation of Arithmetic mean

Marks (X)	**No. of students(f)**	**fX**	**d = (X – 40)**	**d′ = d/10**	**fd**	**fd′**
20	8	160	–20	–2	–160	–16
30	12	360	–10	–1	–120	–12
40	20	800	0	0	0	0
50	10	500	10	1	100	10
60	6	360	20	2	120	12
70	4	280	30	3	120	12
	Σf = 60	**ΣfX = 2,460**			**Σfd = 60**	**Σfd′ = 6**

(i) Direct method:

$$\bar{X} = \frac{\Sigma fX}{\Sigma f} = \frac{2460}{60} = 41$$

Hence the average marks = 41.

(ii) Assumed Mean Method:

$$\bar{X} = A + \frac{\Sigma fd}{N} = 40 + \frac{60}{60} = 40 + 1 = 41$$

Hence the average marks = 41.

(iii) Step-Deviation Method

$$\bar{X} = A + \frac{\Sigma fd'}{\Sigma f} \times c = 40 + \frac{6}{60} \times 10 = 41$$

Hence the average marks = 41.

Example 5: From the following data, find the missing item if the Mean wage is **₹ 115.86**

Wages in (₹):	110	112	113	117	?	125	128	130
No. of workers :	25	17	13	15	14	8	6	2

Solution: Let x be the missing item.

Table 8.4: Calculation of missing Item

Wages in ₹ (X_i)	**Number of workers f_i**	**f_iX_i**
110	25	2750
112	17	1904
113	13	1469
117	15	1755
x	14	14x
125	8	1000
128	6	768
130	2	260
Total	$\Sigma f_i = 100$	$\Sigma f_iX_i = 9906 + 14x$

Now the arithmetic mean $(\bar{X}) = \frac{\Sigma f_i X_i}{\Sigma f_i}$

Therefore, $115.86 = \frac{9906 + 14x}{100}$

or $115.86 \times 100 = 9906 + 14x$

$11586 = 9906 + 14x$

$11586 - 9906 = 14x$

$1680 = 14x$

or $x = \frac{1680}{14}$

$x = 120$

Therefore the missing item is ₹ 120

INTEXT QUESTIONS 8.2

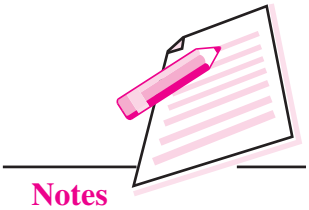
1. Find the mean of the set of ages in the table below:

Age (years)	Frequency
10	0
11	8
12	3
13	2
14	7

2. Find the mean average weekly earnings for the data given in example 3, by using step deviation method.

8.2.1.3 Computation of Arithmetic Mean in case of Continuous series

In case of continuous series, class intervals and frequencies are given. In this case the mid-points of various class intervals are taken for calculating arithmetic mean. It may be noted that class intervals may be exclusive or inclusive or of unequal size. In case of continuous series also the computation of arithmetic mean is done by applying:



(i) Direct Method;

(ii) Assumed Mean Method;

(iii) Step Deviation Method.

(i) Direct Method: The steps involved in the calculation of arithmetic mean are as follows:

1. Calculate the mid-point of each class and denote these mid-points as m as follows:

$$\text{Mid-point } (m) = \frac{\text{Lower Limit} + \text{Upper Limit}}{2}$$

2. Multiply the mid-point with respective frequency and denote these product as fm
3. The arithmetic mean is obtained as follows:

$$\bar{X} = \frac{\Sigma fm}{\Sigma f}$$

(ii) Assumed Mean Method: Under this method the formula for calculating mean is

$$\bar{X} = A + \frac{\Sigma fd}{\Sigma f}$$

Where A = assumed mean d = m – A

f = frequency of n number of observation.

(iii) Step Deviation Method: To make the calculations simpler, we first find a common figure by which all the values of d can be divided. It will reduce the values of d and make further calculations easier. This common factor by which values of d are divided is termed as c i.e. $\left(\frac{d}{c} = d'\right)$. At a later stage the value of d′ is again multiplied by this common factor so that the final result of arithmetic mean is not affected. The steps involved are as follows:

Step 1: Obtain

$$d' = \frac{m - A}{c}$$

where m = mid-point, A = Assumed mean

c = common factor which is the difference between upper limit and lower limit of a class

Step 2: Apply the following formula to calculate arithmetic mean:

$$\bar{X} = A + \frac{\Sigma fd'}{\Sigma f} \times c$$

Example 6: Calculate average Land- size of the farmers of a village from the following data using (a) Direct method (b) Step deviation method.

Size of Land (in hectares)	0-10	10-20	20-30	30-40	40-50	50-60
No. of Farmers	42	44	58	35	26	15

Solution:

Table 8.5: Computation of Land Size for Exclusive Class Interval

Land Size (in hectares)	No. of Farmers(f)	Mid Points (m)	fm	$d' = \frac{m-35}{10}$	fd′
0-10	42	5	210	–3	–126
10-20	44	15	660	–2	–88
20-30	58	25	1450	–1	–58
30-40	35	35	1225	0	0
40-50	26	45	1170	1	26
50-60	15	55	825	2	30
	Σf = 220		Σfm=5540		Σfd′=-216

Applying Direct Method:

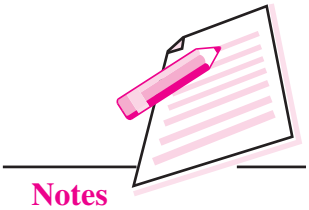
$$\bar{X} = \frac{\Sigma fm}{\Sigma f} = \frac{5540}{220} = 25.2 \text{ hectares}$$

Applying the Step Deviation Method:

$$\bar{X} = A + \frac{\Sigma fd'}{\Sigma f} \times c = 35 + \left(\frac{-216}{220}\right) \times 10 = 25.2 \text{ hectares}$$

INTEXT QUESTIONS 8.3

1. The following distribution gives the pattern of overtime work per month done by 180 employees of a company. Calculate the arithmetic mean.



Overtime (in hrs)	0-10	10-30	30-40	40-50	50-60
No. of Employees	10	60	50	40	20

Solution: Since the class intervals are unequal, the frequencies have to be adjusted to make the class interval equal on the assumption that these are equally distributed throughout the class.

$$\bar{X} = A + \frac{\Sigma fd'}{\Sigma f} \times c = 45 + \left(\frac{-220}{180}\right) \times 10 = 32.778 \text{ hours}$$

2. A company is planning to improve plant safety. For this accident data for the last 180 weeks were compiled. These data are grouped into the frequency distribution as shown below:

No. of accidents	1-10	11-20	21-30	31-40	41-50	51-60
No. of Weeks	10	20	30	50	40	30

Calculate the arithmetic mean of the number of accident per day.

Solution: In this case the inclusive series are converted into exclusive series by deducting half the difference between upper limit of a class and lower limit of next class from the lower limit of class and adding the same to upper limit of class.

$$\bar{X} = A + \frac{\Sigma fd'}{\Sigma f} \times c = 45.5 + \left(\frac{-180}{180}\right) \times 10 = 35.5 \text{ accident per week}$$

8.2.3 Properties of Arithmetic Mean

1. The sum of the deviations, of all the values of X, from their arithmetic mean, is zero.
2. The product of the arithmetic mean and the number of items gives the total of all items.
3. The sum of the squares of the deviations of the items taken from arithmetic mean is minimum.
4. If a constant is added or subtracted to all the variables, mean increases or decreases by that constant.
5. If all the variables are multiplied or divided by a constant, mean also gets multiplied or divided by the constant.

INTEXT QUESTIONS 8.4

Choose the correct answer:

1. The sum of deviations of the individual data elements from their mean is:
   (a) always greater than zero
   (b) always less than zero
   (c) sometimes greater than and sometimes less than zero, depending on the data elements
   (d) always equal to zero
2. In a group of 12 scores, the largest score is increased by 36 points. What effect will this have on the mean of the scores?
   (a) It will be increased by 12 points
   (b) It will remain unchanged
   (c) It will be increased by 3 points
   (d) It will increase by 36 points
   (e) There is no way of knowing exactly how many points the mean will be increased.

8.2.4 Combined Mean

If a series of N observations consists of two components having N_1 and N_2 observations ($N_1+N_2=N$), and means $\bar{X}_1$ and $\bar{X}_2$ respectively then the Combined mean $\bar{X}$ of N observations is given by

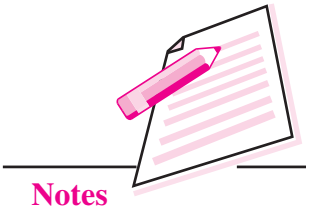
$$\text{Combined mean } \bar{X} = \frac{N_1\bar{X}_1 + N_2\bar{X}_2}{N_1 + N_2}$$

Example 7: The average marks of three batches of students having 70, 50 and 30 students respectively are 50, 55 and 45. Find the average marks of all the 150 students, taken together.

Solution: Let X be the average marks of all 150 students taken together.

Average. marks	$\bar{X}_1 = 50;$	$\bar{X}_2 = 55;$	$\bar{X}_3 = 45$
No. of students	$N_1 = 70;$	$N_2 = 50;$	$N_3 = 30$

$$\bar{X}_{123} = \frac{N_1\bar{X}_1 + N_2\bar{X}_2 + N_3\bar{X}_3}{N_1 + N_2 + N_3}$$



$$= \frac{70\times50+50\times55+30\times45}{70+50+30} = \frac{7600}{150}$$

$\bar{X}_{123}$ = 50.67 marks

INTEXT QUESTIONS 8.5

1. The mean of a certain number of observations is 40. If two or more items with values 50 and 64 are added to this data, the mean rises to 42. Find the number of items in the original data.

2. Eight coins were tossed together and the number of times they fell on the side of heads was observed. The activity was performed 256 times and the frequency obtained for different values of x, (the number of times it fell on heads) is shown in the following table. Calculate then mean by: i) Direct method ii) Short-cut method

X:	0	1	2	3	4	5	6	7	8
f:	1	9	26	59	72	52	29	7	1

3. Calculate the average age of employees working in a company from the following data:

Age (years) below:	25	30	35	40	45	50	55	60
No. of employees:	8	23	51	81	103	113	117	120

8.2.5 Weighted Arithmetic Mean:

In calculating simple arithmetic mean, it is assumed that all the items in the series carry equal importance. But in practice, there are many cases where relative importance should be given to different items. When the mean is computed by giving each data value a weight that reflects its importance, it is referred to as a weighted mean. When data values vary in importance, the analyst must choose the weight that best reflects the importance of each value. If $w_1, w_2, w_3, \ldots w_N$ are weights of N observations in a series $X_1, X_2, X_3, \ldots X_N$ then the weighted mean is calculated as

$$\bar{X}_w = \frac{\Sigma wX}{\Sigma w}$$

Note: If the weights of all the observations are equal i.e. $w_1 = w_2 = w_3, \ldots w_N = w$ Then the weighted A.M is equal to simple A.M i.e. $\bar{X}_w = \bar{X}$.

Example 8: An examination was held to decide the award of scholarship. The weights of various subjects were different. The marks obtained by 3 candidates (out of 100) in each subject are given below:

Subject	Weight	Students		
		A	B	C
Mathematics	40	60	57	62
History	30	62	61	67
Chemistry	20	55	53	60
English	10	67	77	49

Calculate the weighted A.M. to award the scholarship.

Solution:

Table 8.6: Calculation of the weighted arithmetic mean

Subject	Weight	Students					
		A		B		C	
		Marks (X_A)	$X_A w_i$	Marks (X_B)	$X_B w_i$	Marks (X_C)	$X_C w_i$
Mathematics	40	60	2400	57	2280	62	2480
History	30	62	1860	61	1830	67	2010
Chemistry	20	55	1100	53	1060	60	1200
English	10	67	670	77	770	49	490
Total	**100**	**244**	**6030**	**248**	**5940**	**238**	**6180**

Applying the formula for weighted mean, we get

$$\bar{X}_{wA} = \frac{6030}{100} = 60.3 \text{ marks}; \quad \bar{X}_A = \frac{244}{4} = 61 \text{ marks}.$$

$$\bar{X}_{wB} = \frac{5940}{100} = 59.4 \text{ marks}; \quad \bar{X}_B = \frac{248}{4} = 62 \text{ marks}.$$

$$\bar{X}_{wC} = \frac{6180}{100} = 61.8 \text{ marks}; \quad \bar{X}_C = \frac{238}{4} = 59.5 \text{ marks}.$$

From the above calculation, it may be noted that student B should get the scholarship as per simple A.M. values, but according to weighted A.M., student C should get the scholarship because all the subjects of examination are not of equal importance.

INTEXT QUESTIONS 8.6

1. A big mall wants to know the weighted mean of the sales price of 2,000 units of one product that had its final price adjusted according to the first ten days of sales. The table below summarizes the relation between final price and number of sold units.

Price per unit	No. of sold units	Price per unit	No.of sold units
₹ 24.20	354	₹ 24.14	288
₹ 24.10	258	₹ 24.06	240
₹ 24.00	209	₹ 23.95	186
₹ 23.90	133	₹ 23.84	121
₹ 23.82	110	₹ 23.75	101

Compute both the average price and the weighted average sales price of this product

An Evaluation of Arithmatic Mean

Arithmetic mean is easy to calculate**.** All values in the series are used in the calculation of mean, so it can be regarded as more representative of the entire data set. However, mean is affected by extreme items i.e. very high or a very low value in the data set. Thus the mean may be rather lower or higher than most of the values in the data set and so become unrepresentative of the entire data. Mean cannot be calculated in the open-ended frequency distribution.

8.3 MEDIAN

Median is the positional value that divides the series into two equal parts in such a way that half of the items lie above this value and the remaining half lie below this value. In Connor's words - "The median is that value of the variable which divides the group into two equal parts, one part comprising all values greater and the other all values lesser than the median." Median is called a positional average because it is based on the position of a given observation in a series arranged in an ascending or descending order and position of the median is such that equal number of items lie on either side of it. Median is denoted by Med. or M_d.

8.3.1 Computation of Median in case of Individual Series

The steps involved in the calculation of median are as follows:

Step 1: Arrange the data in ascending or descending order.

Step 2: Ascertain $\frac{N+1}{2}$ th item. This will give the position of the median i.e. item/items at which the median lies.

It may be noted that the formula $\frac{N+1}{2}$ th item gives the position of the median in an ordered series, not the median itself. Median is the size of $\frac{N+1}{2}$ th item.

Example 9: The following data relates to the no. of patients examined per hour in the hospital:

No. of Patients Examined	10	12	15	20	13	24	17	18

Calculate the median.

Solution:

Arranging the size of item in ascending order:

No. of Patients Examined	10	12	13	15	17	18	20	24

$$\text{Median} = \text{size of } \left(\frac{N+1}{2}\right)\text{th item} = \left(\frac{8+1}{2}\right)\text{th item}$$

$$= \text{size of } 4.5\text{th item}$$

$$\text{We get Median} = \frac{15+17}{2} = 16$$

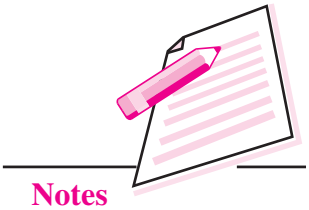
Thus the median no. of patients examined per hour is 16.

Example 10: The following figures represent the number of books in Statistics issued at the counter of a library on 11 different days. 96, 180, 98, 75, 270, 80, 102, 100, 94, 75 and 200. Calculate the median.

Solution: Arrange the data in the ascending order as 75, 75, 80, 94, 96, 98, 100, 102,180, 200, 270.

Now the total number of items 'N'= 11

Therefore, the median $= \text{size of } \left(\frac{N+1}{2}\right)\text{th item}$



$$= \text{size of } \left(\frac{11+1}{2}\right) \text{th item}$$

$$= \text{size of } 6^{th} \text{ item}$$

= 98 books per day

INTEXT QUESTION S 8.7

1. If a data set has an even number of observations, the median
   (a) cannot be determined
   (b) is the average value of the two middle items
   (c) must be equal to the mean
   (d) is the average value of the two middle items when all items are arranged in ascending order

2. A distribution of 6 scores has a median of 21. If the highest score increases 3 points, the median will become:
   (a) 21
   (b) 21.5
   (c) 24
   (d) Cannot be determined without additional information.
   (e) none of these

8.3.2 Computation of Median in case of Discrete Series:

In case of discrete series the position of median i.e. $\frac{N+1}{2}$ th item can be located through cumulative frequency. The steps involved in the calculation of median are as follows:

Step 1: Arrange the data in ascending or descending order of magnitude.

Step 2: find out the cumulative frequency (c.f.)

Step 3: Median = size of $\frac{N+1}{2}$ th item

Step 4: Now look at the cumulative frequency column and find that total which is either equal to $\frac{N+1}{2}$ or next higher to that and determine the value of the variable corresponding to it. That gives the value of median.

Example 11: Calculate Median from the following data:

Marks	45	55	25	35	5	15
No of Students	40	30	30	50	10	20

Solution:

Table 8.7: Calculation of Median Marks

Marks in an Ascending order	No. of students	Cumulative frequencies
5	10	10
15	20	30
25	30	60
35	50	110
45	40	150
55	30	180

Median = size of $\frac{N+1}{2}$ th item = $\frac{180+1}{2}$ item = 90.5th item

Cumulative frequency which includes 90.5^{th} item =110

Median = size of item corresponding to 110 = 35marks.

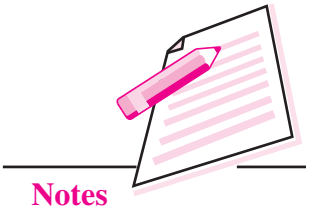
8.3.3 Computation of Median in case of Continuous Series

The steps involved in the calculation of median are as follows:

Step 1: Calculate Cumulative Frequencies.

Step 2: Ascertain $\left[\frac{N}{2}\right]$ th item.

Step 3: Find out the cumulative frequency which includes $\left[\frac{N}{2}\right]$ th item and corresponding class frequency. The corresponding class of this cumulative frequency is called the median class.



Step 4: Calculate Median as Follows:

$$\text{median} = l_1 + \frac{\frac{N}{2} - \text{c.f.}}{f} \times i$$

where l_1 = Lower limit of the median class

c.f. = cumulative frequency of the preceeding class

f = frequency of the median class

i = class interval of median class

Example 12: Calculate the median of weekly expenditure from the following data:

Weekly Expenditure (in ₹)	0-10	10-20	20-30	30-40	40-50
No. of families	14	23	27	21	15

Solution:

Table 8.8: Calculation of Median Weekly Expenditure (in ₹)

Weekly Expenditure (in ₹)	No. of families (f)	Cumulative frequency (c.f)
0-10	14	14
10-20	23	37
20-30	27	64
30-40	21	85
40-50	15	100

Ascertain $\left[\frac{N}{2}\right]$ th item $= \left[\frac{100}{2}\right]$ th item = 50th item lies in class interval as 20-30.

Thus the Median Class is 20-30.

Now applying formula of median

$$\text{Median} = l_1 + \frac{\frac{N}{2} - \text{c.f}}{f} \times \text{i}$$

here l_1 = 20, c.f. = 37, f = 27, i = 10

$$\text{Median} = 20 + \frac{50-37}{27} \times 10$$

= ₹ 24.815

Note that while calculating the median of a series, it must be put in the 'exclusive class-interval' form. If the original series is in inclusive type, first convert it into the exclusive type and then find its median.

INTEXT QUESTIONS 8.8

1. Calculate the median age of the persons from the following data.

Age (years) :	20-25	25-30	30-35	35-40	40-45
No. of person :	70	80	180	150	20

2. Calculate the median marks of the students:

Marks :	40-50	30-40	20-30	10-20	0-10
No. of students :	10	12	40	30	8

8.3.4 Important Mathematical property of median

The sum of the deviations of the items from median, ignoring signs is the least.

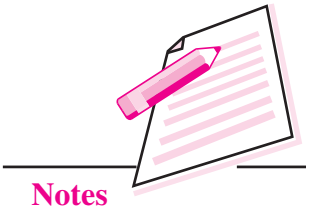
$$\Sigma|X - Md| \text{ is least.}$$

An Evaluation of Median

Since Median is the middle term it is not affected by extreme values and can also be calculated in the open ended frequency distribution. It is not based on all the values of the data set.

8.4 QUARTILES

Quartile is that value which divides the total distribution into four equal parts. So there are three quartiles, *i.e.* Q_1, Q_2 and Q_3 which are termed as first quartile, second quartile and third quartile or lower quartile, middle quartile and upper quartile respectively. Q_1 (quartile one) covers the first 25% items of the series. Q_1 divides the series in such a way that 25% of the observations have the value less than Q_1 and 75% have the value more than Q_1. Q_2 (quartile two) is the median or middle value of the series and Q_3 (quartile three) covers 75% items of the series. Q_3 divides the series in such a way that 75% of the observations have the value less than Q_3 and 25% have the value more than Q_3.



- **Calculation of Quartiles:**

The calculation of quartiles is done exactly in the same manner as it is in case of the calculation of median.

8.4.1 In case of Individual and Discrete Series

$$Q_k = \text{Size of } \frac{k(N+1)}{4} \text{ th item of the series}$$

8.4.2 In case of Continuous Series

$$Q_k = \text{Size of } k\left(\frac{N}{4}\right) \text{th item of the series},$$

Q_k is calculated as follows:

$$Q_k = l_1 + \frac{k\left(\frac{N}{4}\right) - cf}{f} \times i$$

Where, l_1 = Lower limit of quartile class

l_2 = upper limit of quartile class

c = Cumulative frequency preceding the quartile class

f = Frequency of kth quartile class.

Example 13: Find the Q_1 and Q_3 of the following:

(a) 4, 5, 6, 7, 8, 9, 12, 13, 15, 10, 20

(b) 100, 500, 1000, 800, 600, 400, 7000 and 1200

Solution:

(a) Values of the variable are in ascending order:

i.e. 4, 5, 6, 7, 8, 9, 10, 12, 13, 15, 20, So N = 11 (No. of Values)

$$Q_1 = \text{Size of } \frac{(N+1)}{4} \text{ th item of the series}$$

$$= \left(\frac{11+1}{4}\right) = \text{size of } 3^{rd} \text{ item.} = \text{size of 3rd item} = 6$$

$$Q_3 = \text{Size of } \frac{3(N+1)}{4} \text{ th item of the series}$$

$$= 3\left(\frac{11+1}{4}\right) = \text{size of } 9^{th} \text{ item. } = \text{size of 9th item} = 13$$

$\therefore$ Required Q_1 and Q_3 are 6 and 13 respectively,

(b) The values of the variable in ascending order are:

100, 400, 500, 600, 700, 800, 1000, 1200, N = 8

$$Q_1 = \text{Size of } \frac{(N+1)}{4} \text{ th item of the series}$$

$$= \text{Size of } \frac{(8+1)}{4} \text{ th item of the series}$$

= size of 2.25th item

= size of {Second item + 0.25(Third item - Second item)}

= 400 + 0.25 (500 - 400) = 400 + 25 = 425

$$Q_3 = \text{Size of } \frac{3(N+1)}{4} \text{ th item of the series}$$

$$= \text{Size of } \frac{3(8+1)}{4} \text{ th item of the series}$$

= size of 6.75th item

= size of [6th item + 0.75(7th item - 6th item)]

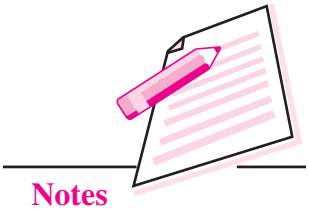
= 800 + 0.75 (1000 - 800)

= 800 + 150 = 950

Required Q_1 and Q_3 are 425 and 950 respectively.

Example 14: Find the median and Q_1 from the following data.

Marks :	0-10	10-30	30-50	50-80	80-90	90-100
No of Students :	4	12	20	8	4	2



Solution: To locate median class firstly we have to calculate cumulative frequencies.

Table 8.9: Calculation of Median and Quartile Marks

Marks	0-10	10-30	30-50	50-80	80-90	90-100
No of Students	4	12	20	8	4	2
Cumulative frequency	4	16	36	44	48	50

Calculation of Median is shown as under:

Here N = 50, so N/2 = 25, hence median class is 30-50

$$\text{Median} = l_1 + \frac{\frac{N}{2} - c.f}{f} \times i$$

$$\text{Median} = 30 + \frac{25-16}{20} \times 20 = 39 \text{ marks}$$

Calculation of Q_1 :

Here N = 50 so N/4 = 12.5, hence Quartile class (Q_1) is 10-30

$$Q_1 = l_1 + \frac{N/4 - cf}{f} \times i$$

$$Q_1 = 10 + \frac{12.5-4}{12} \times 20 = 24.16 \text{ marks}$$

8.5 MODE

Mode (M_0) is the value around which maximum concentration of items occurs. For example, a manufacturer would like to know the size of shoes that has maximum demand or style of the shirt that is more frequently demanded. Here, *Mode* is the most appropriate measure. Mode is the value which is repeated the highest number of times in the series. It is the size of that item which possesses the maximum frequency.

8.5.1 Computation of Mode in case of Ungrouped Data/ Individual series

The mode of this series can be obtained by mere inspection. The number which occurs most often is the mode.

Note that if in any series, two or more numbers have the maximum frequency, then the mode will be difficult to calculate. Such series are called as Bi-modal, Tri-modal or Multi-modal series.

Example 15: Find the mode of 15, 21, 26, 25, 21, 23, 28, 21

Solution: The mode is 21 since it occurs three times and the other values occur only once.

INTEXT QUESTIONS 8.9

1. The most frequently occurring value of a data set is called:

   (a) range (b) mode (c) mean (d) median

2. Find the mode of 12, 15, 18, 26, 15, 9, 12, 27

3. The measure of location which is the most likely to be influenced by extreme values in the data set is the:

   (a) median (b) mode (c) mean (d) Quartile

4. A researcher has collected the following sample individual data

5	12	6	8	5	6	7	5	12	4

   The Median is:

   (a) 5 (b) 6 (c) 7 (d) 8

   And the Mode is:

   (a) 5 (b) 6 (c) 7 (d) 8

5. Which of the following can have more than one value?

   (a) Median; (b) Quartile; (c) mode and (d) mean

8.5.2 Computation of mode in case of discrete series

The mode in case of discrete series is calculated by applying the following methods:

(a) Simple inspection method:

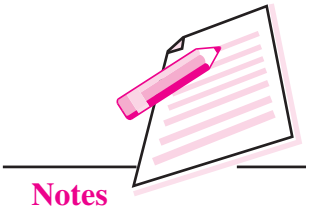
By simple inspection, the modal value is the value of the variable against which the frequency is the largest.

Example 16: Find the modal age of boys studying in XII class from the following data.

Age : (in yrs)	5	7	10	12	15	18
No. of Boys :	4	6	9	7	5	3

Solution:

From the above data we can clearly see that modal age is 10 yrs because 10 has occurred maximum number of times i.e. 9.



b) Grouping and Analysis Table method: This method is generally used when the difference between the maximum frequency and the frequency preceding it or succeeding it is very small.

Process of Computation:

In order to find mode, a grouping table and an analysis table are to be prepared in the following manner:

Grouping Table:

A grouping table consists of 6 columns.

1. Arrange the values in ascending order and write down their corresponding frequencies in the column-1.
2. In column-2 the frequencies are grouped into two's and added.
3. In column-3 the frequencies are grouped into two's, leaving the first frequency and added.
4. In column-4 the frequencies are grouped into three's, and added.
5. In column-5 the frequencies are grouped into three's, leaving the first frequency and added.
6. In column-6 the frequencies are grouped into three's, leaving the first and second frequencies and added.
7. Now in each these columns mark the highest total with a circle.

Analysis Table:

After preparing a grouping table, prepare an analysis table. While preparing this table take the column numbers as rows and the values of the variable as columns. Now for each column number see the highest total in the grouping table (Which is marked with a circle) and mark the corresponding values of the variable to which the frequencies are related by using bars in the relevant boxes. Now the value of the variable (class) which gets highest number of bars is the modal value (modal class).

Applying grouping and Analysis Table Method to the given example for calculating the value of mode for discrete series.

Table 8.10: Grouping Table

Age	Frequency					
	Col I	Col II	Col III	Col IV	Col V	Col VI
5	4	10		**19**		
7	6		**15**		**22**	
10	**9**	**16**				**21**
12	7		12	15		
15	5	8				
18	3					

Analysis Table

Column	5	7	10	12	15	18
Col I			1			
Col II			1	1		
Col III		1	1			
Col IV	1	1	1			
Col V		1	1	1		
Col VI			1	1	1	
Total	1	3	**6**	3	1	0

Thus the Modal age of Boys is 10 years.

8.5.3 Computation of Mode in case of Continuous series

In case of continuous series, for calculating mode, first of all ensure that the given continuous series is the exclusive series with equal class intervals. In order to find out the mode we need one step more than those used for discrete series. As explained in the discrete series, modal class is determined by inspection or by preparing grouping and analysis tables. The steps involved are:

1. Determine the modal class which as the maximum frequency.
2. Value of the mode can be calculated by the formula :

$$\text{Mode} = l_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

l_1 = lower limit of the modal class

f_1 = frequency of the modal class

f_0 = frequency of the preceeding the modal class

f_2 = frequency of the succeeding the modal class

i = class interval of the modal class

Note: 1.It may be noted that in case of continuous series, class intervals should be equal and series should be exclusive to calculate the mode. If the given series is inclusive and has unequal class interval then the same has to be converted into exclusive series and series with equal class interval.

2. If mid points are given, class intervals are to be obtained.

Example 17: From the following data calculate mode:

Age (in years) :	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
No. of Persons :	50	70	80	150	180	120	70	50

Solution:

Table 8.11: Computation of mode

Grouping Table:

Age	Frequency					
	(1)	(2)	(3)	(4)	(5)	(6)
20-25	50	120		200		
25-30	70		150		300	
30-35	80	230				**410**
35-40	150		**330**	**450**		
40-45	**180**	**300**			**370**	
45-50	120		190			240
50-55	70	120				
55-60	50					

Analysis Table

Column	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
1					1			
2					1	1		
3				1	1			
4				1	1	1		
5					1	1	1	
6			1	1	1			
Total	0	0	1	3	6	3	1	0

The modal class is 40-45. Mode is given by:

$$\text{Mode} = l_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

Here L = 40, f_1 = 180, f_0 = 150, f_2 = 120, i = 5

$$\text{Mode} = 40 + \frac{180-150}{(2\times180)-150-120} \times 5 = 40 + \left[\frac{30}{90}\right] \times 5 = 41.67 \text{ years.}$$

Example 18: Calculate the modal wages from the following data:

Daily wages (in ₹):	20-25	25-30	30-35	35-40	40-45	45-50
No. of workers:	1	3	8	12	7	5

Solution: Here the maximum frequency is 12 by inspection method, corresponding to the class interval (35 - 40) which is the modal class.

$$\text{Mode} = l_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

Here L = 35, $f_1 = 12$, $f_0 = 8$, $f_2 = 7$, i = 5

$$\text{Mode} = 35 + \frac{12-8}{(2\times12)-8-7} \times 5 = 35 + \left[\frac{4}{9}\right] \times 5 = 37.22 \text{ (in rup}$$

Modal wages is ₹ 37.22

An Evaluation of Mode

Mode is not affected by extreme values and can be calculated in the open ended frequency distribution.

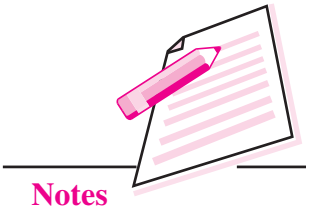
Example 19: The following table shows the daily wages of a random sample of construction workers. Calculate its mean, median and mode.

Daily Wages (₹)	Number of Workers
200 - 399	5
400 - 599	15
600 - 799	25
800 - 999	30
1000 - 1199	18
1200 - 1399	7
Total	100

Solution:

Table 8.12: Calculation of Mean

Daily Wages (₹)	Number of Workers (f)	Class Mark m	fm
200 - 399	5	299.5	1,497.5
400 - 599	15	499.5	7,492.5
600 - 799	25	699.5	17,489.5
800 - 999	30	899.5	26,985.0
1000 - 1199	18	1,099.5	19,791.0
1200 - 1399	7	1,299.5	9,096.5
Total	100		82,352.0



$$\textbf{Mean } (\bar{X}) = \frac{\Sigma fm}{\Sigma f} = \frac{82,352.0}{100} = 823.52 \text{ (in rupees)}$$

Thus Mean Wages are ₹ 823.52

In order to calculate the mode and median the given series has to be converted from inclusive series into exclusive series.

Table 8.13: Calculation of Median

Daily Wages (₹)	Number of Workers(f)	Cumulative Frequency
199.5 – 399.5	5	5
399.5 – 599.5	15	20
599.5 – 799.5	25	45
799.5 – 999.5	30	75
999.5 – 1199.5	18	93
1199.5 – 1399.5	7	100
Total	100	

$$\text{Median} = l_1 + \frac{\frac{N}{2} - c.f}{f} \times i$$

Here N = 100 so N/2 = 50, hence median class is 799.5 – 999.5

$$\text{Median} = 799.5 + \frac{50-45}{30} \times 200 = 832.83 \text{ (in Rupees)}$$

So the median daily wage is ₹ 832.8

Table 8.14: Computation of Mode

Grouping Table

Daily Wages (₹)	Frequency					
	(1)	(2)	(3)	(4)	(5)	(6)
199.5-399.5	5	20		45		
399.5-599.5	15		40		**70**	
599.5-799.5	25	**55**				**73**
799.5-999.5	**30**		**48**	**55**		
999.5-1199.5	18	25				
1199.5-1399.5	7					

Analysis Table

Col.	199.5- 399.5	399.5- 599.5	599.5-799.5	799.5-999.5	999.5-1199.5	1199.5-1399.5
1				1		
2			1	1		
3				1	1	
4				1	1	1
5		1	1	1		
6			1	1	1	
Total	0	1	3	6	3	1

The modal class is 799.5 – 999.5. Mode is given by:

$$\text{Mode} = l_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

Here $l_1 = 799.5$, $f_1 = 30$, $f_0 = 25$, $f_2 = 18$, $i = 200$

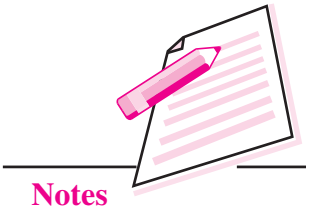
$$\text{Mode} = 799.5 + \frac{30 - 25}{(2 \times 30) - 25 - 18} \times 200$$

$$= 799.5 + \left[\frac{5}{17}\right] \times 200 = 858.32 \text{ (in Rupees).}$$

Thus the modal wage is ₹858.32

WHAT YOU HAVE LEARNT

- The measure of central tendency identifies the single value that is most typical/ representative of the entire data-set.
- The following are the important measures of central tendency:
  - Arithmetic mean.
    - Simple arithmetic mean.
    - Weighted arithmetic mean.
  - Median
  - Quartiles.
  - Mode.



- The arithmetic mean in case of individual series can be computed using
  - **Direct Method**

$$\bar{X} = \frac{\Sigma X}{N}$$

  - **Assumed Mean Method**

$$\bar{X} = A + \frac{\Sigma d}{N}$$

  where $\bar{X}$ = Arithemetic mean, A = Assumed mean

  Σd = sum of deviations, N = Number of Individual observations

- Arithmetic Mean in case of discrete series is given by:
  - **Direct Method**

$$\bar{X} = \frac{\Sigma fX}{\Sigma f}$$

  where Σf = total frequency

  - **Assumed Mean Method**

$$\bar{X} = A + \frac{\Sigma fd}{N}$$

  where A = assumed mean, d = X – A and N = Σf

  - **Step Deviation Method**

$$\bar{X} = A + \frac{\Sigma fd'}{\Sigma f} \times c$$

- Arithmetic Mean in case of continuous series is given by:
  - **Direct Method**

$$\bar{X} = \frac{\Sigma fm}{\Sigma f}$$

  where $\text{Mid-point } (m) = \frac{\text{Lower Limit} + \text{Upper Limit}}{2}$

  - **Assumed Mean Method**

$$\bar{X} = A + \frac{\Sigma fd}{\Sigma f}$$

  where A = assumed mean d = m – A

  f = frequency of n number of observation.

- **Step Deviation Method**

$$\bar{X} = A + \frac{\Sigma fd'}{\Sigma f} \times c$$

where $d' = \frac{m - A}{c}$

m = mid-point, A = Assumed mean

c = common factor which is the difference between upper limit and lower limit of a class

- The combined mean of two series is given by

$$\text{Combined mean } \bar{X} = \frac{N_1\bar{X}_1 + N_2\bar{X}_2}{N_1 + N_2}$$

where N_1 and N_2 are no. of items in the two series and $\bar{X}_1$ and $\bar{X}_2$ are the means of two series.

- The weighted arithmetic mean is given by:

$$\frac{\Sigma wX}{\Sigma w}$$

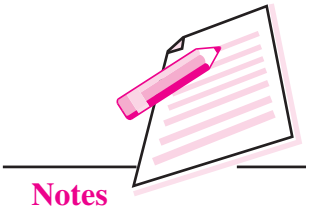
where $w_i = w_1, w_2, w_3, \ldots w_N$ are weights of N observations in a series and $x_i = x_1, x_2, x_3, \ldots x_N$ are N observations in the series.

- Median is the positional value that divides the series into two equal parts in such a way that half of the items lie above this value and the remaining half lie below this value.
- In individual and discrete series, the formula to calculate median is :

$$\text{Median} = \text{size of } \frac{N+1}{2} \text{ th item}$$

- If the number of observations is even then median is given by

$$\text{Median} = \left[\frac{\text{size of } \left(\frac{N}{2}\right)^{th} + \text{size of } \left(\frac{N}{2}+1\right)^{th}}{2}\right]$$



- Median in case of cumulative series is given by:

$$\text{Median} = \text{size of } \left(\frac{N}{2}\right) \text{th item}$$

$$\text{Median} = l_1 + \frac{\frac{N}{2} - \text{c.f}}{\text{f}} \times \text{i}$$

where l_1 = Lower limit of the median class

c.f. = cummulative frequency of the preceeding class

f = frequency of the median class

i = class interval of median class

- Quartile is the value which divides the total distribution into four equal parts. There are three quartiles, i.e. Q_1, Q_2 and Q_3 which are termed as first quartile, second quartile and third quartile or lower quartile, middle quartile and upper quartile respectively.

- In case of Individual and Discrete Series, the quartiles are computed by:

$$Q_k = \text{Size of } \frac{k(N+1)}{4} \text{ th item of the series}$$

- In case of Continuous Series the quartiles are computed by:

$$Q = l_1 + \frac{k\left(\frac{N}{4}\right) - cf}{f} \times i$$

where l_1 = Lower limit of ith quartile class

l_2 = upper limit of ith quartile class

c = Cumulative frequency preceding the ith quartile class

f = Frequency of kth quartile class.

- Mode is the value around which maximum concentration of items occurs.

- Mode in case of ungrouped or Individual series is the number which occurs most often in data.

- The mode in case of grouped data (discrete series and continuous series) is the value of the variable against which the frequency is the largest.

TERMINAL EXERCISE

Mean

1. An average daily wages of all 90 workers in a factory is ₹. 60. An average daily wages of non-technical workers is ₹. 45. Calculate an average daily wages of technical workers if one-third workers are technical.

2. For the two frequency distribution given below, the mean calculated from the first was 25.4 and that from the second was 32.5. Find the values of x and y.

Class Interval	Distribution I	Distribution II
10-20	20	4
20-30	15	8
30-40	10	4
40-50	x	2x
50-60	y	y

3. The mean of 99 items is 55. The value of 100^{th} item is 99 more than the mean of 100 items. What is the value of 100^{th} item

Median

4. The length of time taken by each of 18 workers to complete a specific job was observed to be the following:

Time(in min)	5-9	10-14	15-19	20-24	25-29
No. of workers	3	8	4	2	1

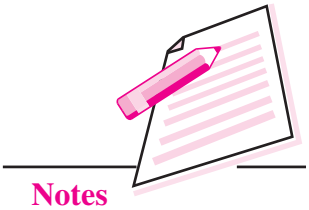
Calculate the median time and Q_1 and Q_3

5. Calculate the median from the following data:

Mid values	115	125	135	145	155	165	175	185	195
frequency	6	25	48	72	116	60	38	22	3

6. If the quartiles for the following distribution are Q_1= 23.125 and Q_3=43.5, find the median:

Daily Wages	0-10	10-20	20-30	30-40	40-50	50-60
No. of workers	5	-	20	30	-	10



7. The mean and median of a group of 25 observations are 143,144, and 147 respectively. A set of 6 observations is added to this data with values 132, 125, 130, 160, 165 and 157. Find mean and median for the combined group of 31 observations.

Mode

8. Locate mode in the data:

7, 12, 8, 5, 9, 6, 10, 9, 4, 9, 9

9. Determine the modal value in the following series:

Value	10	12	14	16	18	20	22	24	26	28	30	32
frequency	7	15	21	38	34	34	11	19	10	38	5	2

10. The median and mode of the following wage distribution are known to be ₹. 33.5 and ₹. 34 respectively. Three frequency values from the table are however missing. Find the missing values.

Wages in ₹	Frequencies
0-10	10
10-20	10
20-30	?
30-40	?
40-50	?
50-60	6
60-70	4
	230

11. The details of monthly salary of various categories of employees working in a university are given below. From these details , calculate mode of monthly salary.

Category	Monthly Salary (₹)	No. of employees
Principal	10,00,000	1
Vice Principal	2,50,000	1
Senior	75,000	5
Professor Professor	30,000	8
Associate Professor	20,000	13
Assistant Professor	18,000	9

12. The distribution of age of patients turned out in a hospital on a particular day was as under:

Age (in years)	No. of patients
More than 10	148
More than 20	124
More than 30	109
More than 40	71
More than 50	30
More than 60	16
More than 70 and upto 80	1

Find the median age and modal age of the patients.

ANSWERS TO INTEXT QUESTIONS

8.1

1. (c) 2. 7

8.2

1. 12.4 years 2. 41

8.4

1. (d) 2. (c)

8.5

1. 15 2. 3.97 3. 36.83 years

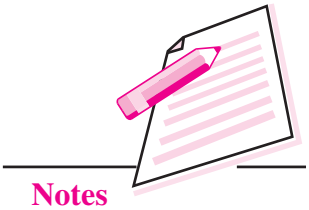
8.6

1. Average price ₹23.98

   Weighted mean for sales in the first ten days ₹24.03

8.7

1. (d)
2. (a) Median will remain the same



8.8

1. 32.78 years
2. 23 marks

8.9

1. (b)
2. The modes are 12 and 15 since both occur twice
3. (c)
4. (b)
5. (c)

Notes

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9

MEASURES OF DISPERSION

The previous lesson provides the measure of central tendency that sum up or describe the data into a single representative value. The measures of central tendency may not be adequate to describe data unless we know the manner in which the individual items scatter around it. In other words, a further description of a series on the scatter or variability known as **dispersion** is necessary, if we are to gauge how representative the average is.

Let us take the following three sets.

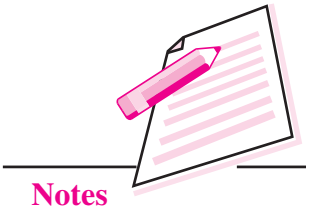
Students	Group X	Group Y	Group Z
1	50	45	05
2	50	50	45
3	50	55	100
mean $\bar{X}$	50	50	50

Thus, the three groups have same mean i.e. 50. In fact the median of group X and Y are also equal. Now if one would say that the students from the three groups are of equal capabilities, it is totally a wrong conclusion. Close examination reveals that in group X students have equal marks as the mean, students from group Y are very close to the mean but in the third group Z, the marks are widely scattered. It is thus clear that the measures of the central tendency is alone not sufficient to describe the data. The measure of dispersion helps us to know the degree of variability in the data and provide a better understanding of the data.

OBJECTIVES

After completing this lesson, you will be able to:

- know the meaning and need of measures of dispersion;



- distinguish between absolute and the relative measures of dispersion;
- apply the various measures of dispersion; and
- calculate and compare the different measures of dispersion.

9.1 MEANING OF DISPERSION

Dispersion is the extent to which values in a distribution differ from the average of the distribution.

In measuring dispersion, it is imperative to know the amount of variation (absolute measure) and the degree of variation (relative measure). In the former case we consider the range, Quartile Deviation, standard deviation etc. In the latter case we consider the coefficient of range, coefficient quartile deviation, the coefficient of variation etc.

9.1.1 Absolute and Relative Measures of Dispersion

The dispersion of a series may be measured either absolutely or relatively. If the dispersion is expressed in terms of the original units of the series, it is called absolute measure of dispersion. The disadvantage of absolute measure of dispersion is that it is not suitable for comparative study of the characteristics of two or more series.

For example if the data is expressed in kilograms then the absolute variation will also be expressed in kilograms but if the same data is expressed in grams then the variation will appear 1000 times more. So for comparison point of view it is necessary to calculate the relative measures of dispersion which are expressed as percentage form (i.e. unitless number). These types of expressions are called coefficients of dispersion. Each absolute measure of dispersion has a relative measure of dispersion.

9.2 MEASURES AND METHODS OF COMPUTING DISPERSION

The following are the important measures of dispersion:

1. Range
2. Quartile deviation or Semi-Inter quartile range.
3. Mean deviation
4. Standard deviation
5. Lorenz Curve

Range and Quartile Deviation measure the dispersion by calculating the spread within which the values lie. Mean Deviation and Standard Deviation calculate the extent to which the values differ from the average.

9.2.1 Range

Range (R) is the difference between the largest (L) and the smallest value (S) in a distribution. Thus

$$\text{Range (R)} = L - S$$

Coefficient of Range: It is a relative measure of the range. It is used in the comparative study of the dispersion

$$\text{co-efficient of Range} = \frac{L-S}{L+S}$$

In case of continuous series Range is just the difference between the upper limit of the highest class and the lower limit of the lowest class.

Range: Evaluation

Range is very simple to understand and easy to calculate. However, it is not based on all the observations of the distribution and is unduly affected by the extreme values. Any change in the data not related to minimum and maximum values will not affect range. It cannot be calculated for open-ended frequency distribution.

Example 1: The amount spent (in ₹) by the group of 10 students in the school canteen is as follows:

110, 117, 129, 197, 190, 100, 100, 178, 255, 790.

Find the range and the co-efficient of the range.

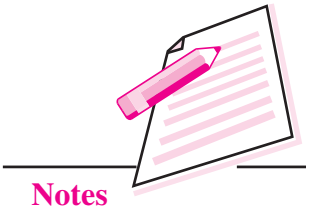
Solution: R = L - S = 790 - 100 = ₹ 690

$$\text{Co-efficient of Range} = \frac{L-S}{L+S} = \frac{790-100}{790+100} = \frac{690}{890} = 0.78$$

Example 2: Find the range and it's co-efficient from the following data.

Size	10-20	20-30	30-40	40-50	50-100
Frequency	2	3	5	4	2

Solution: R = L – S = 100 – 10 = 90



$$\text{Co-efficient of range} = \frac{L-S}{L+S} = \frac{100-10}{100+10} = \frac{90}{110} = 0.82$$

INTEXT QUESTIONS 9.1

1. The difference between the largest and the smallest data values is the

   (a) variance (b) inter-quartile range

   (c) range (d) coefficient of variation

2. A researcher has collected the following sample data. The mean of the sample is 5.

   3 5 12 3 2

   The range is

   (a) 1 (b) 2 (c) 10 (d) 12

9.2.2 Quartile Deviation

It is based on the lower quartile Q_1 and the upper quartile Q_3. The difference $Q_3 - Q_1$ is called the inter-quartile range. The difference $Q_3 - Q_1$ divided by 2 is called semi-inter-quartile range or the quartile deviation.

$$\text{Thus Quartile Deviation (Q.D)} = \frac{Q_3 - Q_1}{2}$$

9.2.2.1 Coefficient of Quartile Deviation

A relative measure of dispersion based on the quartile deviation is called the coefficient of quartile deviation. It is defined as

$$\text{Coefficient of Quartile Deviation} = \frac{\frac{Q_3 - Q_1}{2}}{\frac{Q_3 + Q_1}{2}} = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

It is pure number free of any units of measurement. It can be used for comparing the dispersion in two or more than two sets of data.

9.2.2.2 Computation of Quartile Deviation of Ungrouped Data

Example 3: Find out the quartile deviation of daily wages (in ₹) of 7 persons is given below:120,70,150,100,190,170,250

Solution:

Arranging the data in an ascending order we get

70, 100, 120, 150, 170, 190, 250

Here n = 7,

$$Q_1 = \text{Size of } \frac{(N+1)}{4} \text{ th item}$$

$$= \text{Size of } \frac{(7+1)}{4} \text{ th item} = 2^{nd} \text{ item} = 100 \text{ rupees}$$

$$Q_3 = \text{Size of } \frac{3(N+1)}{4} \text{ th item}$$

$$= \text{Size of } \frac{3(7+1)}{4} \text{ th item} = 6^{th} \text{ item} = 190 \text{ rupees}$$

$$\text{Q.D.} = \frac{Q_3 - Q_1}{2} = \frac{190-100}{2} = 45 \text{ rupees}$$

INTEXT QUESTION 9.2

1. If the first quartile is 104 and quartile deviation is 18. Find the third quartile.

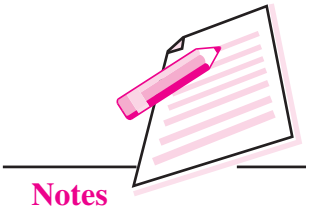
Example 4: The wheat production (in Kg) of 20 acres is given as: 1120, 1240, 1320, 1040, 1080, 1200, 1440, 1360, 1680, 1730, 1785, 1342, 1960, 1880, 1755, 1720, 1600, 1470, 1750, and 1885. Find the quartile deviation and coefficient of quartile deviation.

Solution:

After arranging the observations in ascending order, we get 1040, 1080, 1120, 1200, 1240, 1320, 1342, 1360, 1440, 1470, 1600, 1680, 1720, 1730, 1750, 1755, 1785, 1880, 1885, 1960.

$$Q_1 = \text{value of } \left(\frac{N+1}{4}\right) \text{th item}$$

$$= \text{Value of } \left(\frac{20+1}{4}\right) \text{th item}$$



= Value of (5.25)th item

= 5th item + 0.25(6th item – 5th item)

= 1240 + 0.25(1320 – 1240)

Q_1 = 1240 + 20 = 1260

Q_1 = 1240 + 20 = 1260 kg

$$Q_3 = \text{Value of } \frac{3(N+1)}{4} \text{ th item}$$

$$= \text{Value of } \frac{3(20+1)}{4} \text{ th item}$$

= Value of (15.75)th item

= 15th item + 0.75(16th item – 15th item)

= 1750 + 0.75 (1755 – 1750)

Q_3 = 1750+3.75 = 1753.75 kg

Quartile Deviation (Q.D)

$$= \frac{Q_3 - Q_1}{2} = \frac{1753.75 - 1260}{2} = \frac{492.75}{2} = 246.875$$

$$\text{Q.D.} = \frac{Q_3 - Q_1}{2} = \frac{1753.75 - 1260}{2}$$

$$= \frac{492.75}{2} = 246.875\text{kg.}$$

Coefficient of Quartile Deviation

$$= \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{1753.75 - 1260}{1753.75 + 1260} = 0.164$$

Computation of Q.D. for a frequency distribution

9.2.2.2 Computation in case of Discrete Series:

Example 5: The Tax authority collected the following amount of tax from different firms in a particular market.

Amount of Taxes (in 000 ₹)	10	11	12	13	14
No. of Firms	3	12	18	12	3

Calculate the quartile deviation and the coefficient of quartile deviation.

Solution:

Table 9.1: Calculation of Quartile deviation

Amount of Taxes (in '000 ₹)	No. of Firms (f)	Cummulative Frequency (C.F.)
10	3	3
11	12	15
12	18	33
13	12	45
14	3	48
	Σf = 48	

Here N = 48,

$$Q_1 = \text{Size of } \frac{(N+1)}{4} \text{ th item}$$

$$= \text{Size of } \frac{(48+1)}{4} \text{ th item}$$

$$= \text{Size of } 12.25^{th} \text{ item} = 11 \text{ (in '000 rupees)}$$

$$Q_3 = \text{Size of } \frac{3(N+1)}{4} \text{ th item}$$

$$= \text{Size of } \frac{3(48+1)}{4} \text{ th item}$$

$$= \text{Size of } 36.75^{th} \text{ item} = 13 \text{ (in '000 rupees)}$$

$$\text{Q.D.} = \frac{Q_3 - Q_1}{2} = \frac{13-11}{2} = 1 \text{ (in '000 rupees)}$$

$$\text{Coeff of Q.D.} = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{13-11}{13+11} = 0.083$$

9.2.2.3 Computation of Q.D. for a Continuous Series

Example 6: Calculate quartile deviation and coefficient of quartile deviation from the following distribution:

Weekly Wages(in '000 ₹)	5-7	8-10	11-13	14-16	17-19
No. of Workers	14	24	38	20	04

Solution:

Table 9.2: Calculation of Quartile deviation and coefficient of quartile deviation

Weekly Wages (in '000 ₹)	No. of Workers (f)	Cummulative Frequency (C.F.)
4.5-7.5	14	14
7.5-10.5	24	38
10.5-13.5	38	76
13.5-16.5	20	96
16.5-19.5	4	100
	Σf = 100	

$$Q_1 = l_1 + \frac{l_2 - l_1}{f}\left(\frac{N}{4} - cf\right)$$

$\frac{N}{4} = 25$. Q_1 lies in the class of 7.5-10.5

$$Q_1 = l_1 + \frac{l_2 - l_1}{f}\left(\frac{N}{4} - cf\right) = 7.5 + \frac{25-14}{24} \times 3 = 8.875 \text{ (in ₹000)}$$

$$Q_3 = l_1 + \frac{l_2 - l_1}{f}\left(\frac{3N}{4} - cf\right) = 10.5 + \frac{75-38}{38} \times 3 = 13.42 \text{ (in ₹000)}$$

$$\text{Q.D.} = \frac{Q_3 - Q_1}{2} = \frac{13.42 - 8.875}{2} = 2.273 \text{ (in ₹000)}$$

$$\text{Coeff. of Q.D.} = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{13.42 - 8.875}{13.42 + 8.875} = 0.21$$

Quartile Deviation: An Evaluation

Since Quartile deviation is based only on Q_1 and Q_3, it means this measure is based on middle 50% of the data of the series. Thus unlike range, Quartile deviation is not affected' by extreme items as it ignores 25% of the data from the beginning of the dataset and 25% of the data from the end (data arranged in ascending order). It can be calculated in case of open-ended distribution. However, it is not based on all the observations in the data.

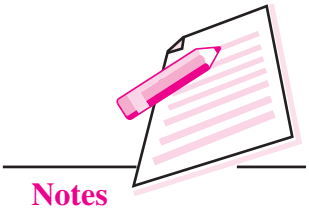
INTEXT QUESTIONS 9.3

1. Which of the following is a measure of dispersion?
   (a) percentiles
   (b) quartiles
   (c) inter-quartile range
   (d) all of the above are measures of dispersion
2. The inter-quartile range is
   (a) the 50th percentile
   (b) another name for the standard deviation
   (c) the difference between the largest and smallest values
   (d) the difference between the third quartile and the first quartile
3. Which of the following limitation of the range is overcome by the inter-quartile range?
   (a) the sum of the range variances is zero
   (b) the range is difficult to compute
   (c) the range is influenced too much by extreme values
   (d) the range is negative
4. A researcher has collected the following sample data. The mean of the sample is 5.

   3 5 12 3 2

   The inter-quartile range is:

   (a) 1 (b) 2 (c) 10 (d) 12



9.2.3 Mean Deviation

Mean deviation (MD) of a series is the arithmetic average of the deviation of various items from a measure of central tendency (mean, median and mode)

Mean deviation is based on the items of the distribution and is calculated as an average, on the basis of deviation obtained from either mean, median or mode but generally from the median.

First we compute deviations of all the items from either mean or median ignoring plus (+) and (–) signs. They are called absolute values of deviations where the two parallel bars (ii) indicate that the absolute value is taken. This is also called modulas value. Then the aggregate of these deviations are divided by the number of observations this is called mean deviation.

9.2.3.1 Calculation of mean deviation

(i) Arrange the data in ascending order (for calculating of median)

(ii) Calculate median/mean/mode

(iii) Take deviations of items from median/mean ignoring ± signs and denote the column as |D|

(iv) Calculate the sum of these deviation in case of discrete and continuous series |D| is multiplied by respective frequency of the item to get Σf |D|

(v) Divide the total obtained by number of items to get mean deviation

$$\text{M.D.} = \frac{\Sigma f |D|}{N}$$

(vi) apply the formula to get coefficient of mean deviation

$$\text{Coefficient of M.D.} = \frac{\text{M.D}}{\text{Median / Mean / Mode}}$$

Example 6: Calculate mean deviaiton and coefficient of mean deviation from both mean and median for the following data on the monthly income (in ₹) of households

Income (₹) 8520 6350 7920 8360 7500

Table 9.3: Calculation of mean deviaiton from median

Monthly Income (₹)	Deviation from mean (7730) ignoring ± signs |D|	Deviations from median (7920) ignoring ± signs |D|
6350	1380	1570
7500	230	420
7920	190	0
8360	630	440
8520	790	600
$\Sigma X = 38650$	$\Sigma\|D\| = 3220$	$\Sigma\|D\| = 3030$

$$\text{Mean} = \frac{\Sigma X}{N}$$

$$= \frac{38650}{5} = 7730$$

$$\text{M.D.} = \frac{\Sigma|D|}{N}$$

$$= \frac{3220}{5} = \text{Rs } 644$$

$$\text{Coefficient of M.D.} = \frac{\text{M.D.}}{\text{Mean}}$$

$$= \frac{644}{7730} = 0.083$$

$$\text{and Median} = \text{Size of } \left(\frac{N+1}{2}\right)^{th} \text{ item}$$

$$= \text{Size of } \left(\frac{5+1}{2}\right)^{th} \text{ item}$$

$$= \text{Size of 3rd item}$$

$$= ₹\ 7920$$

$$\text{Mean Deviation} = \frac{\Sigma|D|}{N}$$

$$= \frac{3030}{5} = \text{Rs } 606$$

$$\text{Coefficient of M.D.} = \frac{\text{M.D.}}{\text{Median}}$$

$$= \frac{606}{7920} = 0.076$$

9.2.3.2 Calculation of mean deviaiton in discrete series

Example 7: Calculate (a) median (b) mean deviation and (c) Coefficient of mean deviation

Size of item (X)	6	12	18	24	30	36	42
Frequency (f)	4	7	9	18	15	10	5

Solution.

Table 9.4: Calculation of mean deviaiton from Median

X	f	cf	|D|	f|D|
6	4	4	18	72
12	7	11	12	84
18	9	20	6	54
24	18	38	0	0
30	15	53	6	90
36	10	63	12	120
42	5	68	18	90
	$\Sigma f = 68$		$\Sigma \lvert D \rvert = 72$	$\Sigma f \lvert D \rvert = 510$

$$\text{Median} = \text{Size of } \left(\frac{N+1}{2}\right)^{th} \text{ item}$$

$$= \text{Size of } \left(\frac{68+1}{2}\right)^{th} \text{ item}$$

$$= 34.5\text{th item}$$

$$\text{M.D.} = \frac{\Sigma f |D|}{N} = \frac{510}{68} = 7.5$$

$$\text{Coefficient of M.D.} = \frac{\text{M.D.}}{\text{Median}} = \frac{7.5}{24} = 0.312$$

Calculation of mean deviaiton in continuous series

Example 8: Calculate (i) mean, (ii) mean deviation from mean and (iii) co-efficient of mean deviation.

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	5	8	15	16	6

Solution: Calculation of mean deviation from mean

Table 9.5: Calculation of mean deviaiton from Mean

Marks X	No of students f	Mid-point m	$\frac{m-25}{10}$	fd′	|D| = m – 27	f|D|
0-10	5	5	–2	–10	22	110
10-20	8	15	–1	–8	12	96
20-30	15	25	0	0	2	30
30-40	16	35	+1	+16	8	128
40-50	6	45	+2	+12	18	108
	Σf = 50			Σfd′ = 10		Σf|D|= 472

$$\bar{X} = A + \frac{\Sigma fd'}{N} \times c$$

$$= 25 + \frac{10}{50} \times 10 = 27 \text{ Marks}$$

$$\text{M.D.} = \frac{\Sigma f|D|}{N} = \frac{472}{50} = 9.44 \text{ Marks}$$

$$\text{Coefficient of M.D.} = \frac{\text{M.D.}}{\text{Mean}} = \frac{9.44}{27} = 0.349$$

Mean deviaiton: An evaluation

Mean deviation ignores the ± signs of the deviation which is mathematically unsound and illogical. Therefore, this method is non-algebraic. Moreover, it can not be computed for distribution for open end classes.

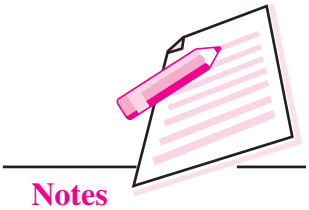
INTEXT QUESTIONS 9.4

(i) Calculated mean deviation and co-efficient of mean deviation from median

No of tomatoes per plant	0	1	2	3	4	5	6	7	8	9	10
No of plants	2	5	7	11	18	24	12	8	6	4	3

(ii) Calculate mean deviation from mean

Class:	3-4	4-5	5-6	6-7	7-8	8-9	9-10
Frequency	3	7	22	60	85	32	8



9.2.4 Standard Deviation (S. D.)

Standard deviation is the most important and commonly used measure of dispersion. It measures the absolute dispersion or variability of a distribution. Standard deviation is the positive square root of the mean of the squared deviations of observations from their mean. It is denoted by S.D. or σ_x.

9.2.4.1 Computation of Standard deviation in case of Individual Series

The following four methods are used to calculate the standard deviation:

1. Actual Mean Method

Let X variable takes on N values i.e. $X_1, X_2, \ldots X_N$. The standard deviation of these N observations using actual mean method can be computed as follows:

1. Obtain the arithmetic mean $(\bar{X})$ of the given data.
2. Obtain the deviation of each i^{th} observation from $\bar{X}$ i.e. $(X_i - \bar{X})$. (Note that $\Sigma(X_i - \bar{X}) = 0$)
3. Square each deviation i.e. $(X_i - \bar{X})^2$
4. Obtain the sum in step 3 i.e. $\sum_{i=1}^{N} (X_i - \bar{X})^2$
5. Obtain the square root of the mean of these squared deviations as follows:

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\Sigma(X - \bar{X})^2}{N}}$$

N = Total No. of observation

2. Assumed Mean Method

This method is applied to calculate the standard deviation when the mean of the data is in fraction. In that case it is difficult and tedious to find the deviation of all observations from the actual mean by the above method. Thus the deviations (d) are taken from the Assumed mean (A) and standard deviation is estimated by using the following formula:

$$\text{Standard Deviation } (\sigma_x) = \sqrt{\frac{\Sigma d^2}{N} - \left(\frac{\Sigma d}{N}\right)^2}$$

where d = (X – A) i.e. deviation taken from the assumed mean (A)

3. Direct Method

The relevance of this method is particularly useful when the items are very small. To obtain standard deviations, we apply the following formula:

$$\text{Standard Deviation } (\sigma_x) = \sqrt{\frac{\sum X^2}{N} - \left(\bar{X}\right)^2}$$

where $\bar{X}$ = arithemetic mean

(Note: The direct method basically implies taking deviations from zero)

4. Step Deviation Method

In this method we divide the deviations by a common class interval (c) and use the following formula for computing standard deviation:

$$\text{Standard Deviation } (\sigma_x) = \sqrt{\frac{\sum d'^2}{N} - \left(\frac{\sum d'}{N}\right)^2} \times c$$

where $d' = \left(\frac{X - A}{c}\right)$ i.e. deviation taken from the assumed mean and divide by class interval (c)

Example 9: The wholesale price of a commodity for 6 days in a month of February 2014 is as follows:

Days	1	2	3	4	5	6
Commodity Price(₹ Per Quintal)	5	15	25	35	45	55

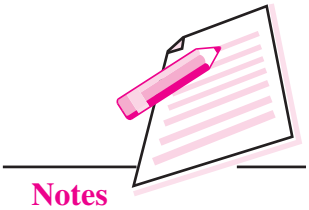
Compute the standard deviation using:

(i) Actual Mean Method

(ii) Assumed Mean Method

(iii) Direct Method and

(iv) Step-Deviation Method



Solution:

Table 9.6: Calculation of standard deviation

Days	Price (₹ Per Quintal)	$(X - \bar{X})$ $= (X - 30)$	$(X - \bar{X})^2$ $= (X - 30)^2$	d = $(X - 40)$	d^2 = $= (X - 40)^2$	X^2	$d' = \frac{X - 40}{5}$	d'^2
1	5	-25	625	–35	1225	25	–7	49
2	15	-15	225	–25	625	225	–5	25
3	25	-5	25	–15	225	625	–3	9
4	35	5	25	–5	25	1225	–1	1
5	45	15	225	5	25	2025	1	1
6	55	25	625	15	225	3025	3	9
		$\Sigma(X - \bar{X})$ $= 0$	$\Sigma(X - \bar{X})^2$ $= 1750$	Σd $= -60$	Σd^2 $= 2350$	ΣX^2 $= 7150$	$\Sigma d'$ $= -12$	$\Sigma d'^2$ $= 94$

Applying Actual Mean Method

$$\bar{X} = \frac{\Sigma X}{N} = \frac{180}{6} = 30 \text{ (in Rupees)}$$

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\Sigma (X - \bar{X})^2}{N}} = \sqrt{\frac{1750}{6}} = 17.078 \text{ (in rupees)}$$

Applying Assumed Mean Method:

Here $$\bar{X} = A + \frac{\Sigma d}{N} = 40 + \frac{-60}{6} = 30$$

$$\text{Standard Deviation } (\sigma_x) = \sqrt{\frac{\Sigma d^2}{N} - \left(\frac{\Sigma d}{N}\right)^2}$$

$$\Sigma d^2 = 2350, \ \Sigma d = -60, N = 6$$

$\therefore$ $$(\sigma_X) = \sqrt{\frac{2350}{6} - \left(\frac{-60}{6}\right)^2} = \text{Rs.}17.078$$

Applying Direct Method

$$\text{Standard Deviation } (\sigma_x) = \sqrt{\frac{\sum X^2}{N} - \left(\bar{X}\right)^2}$$

where $\bar{X} = 30,\ \sum X^2 = 7150,\ N = 6$

$$\therefore \quad (\sigma_X) = \sqrt{\frac{7150}{6} - (30)^2} = \text{Rs.}17.078$$

Applying Step Deviation Method

$$\text{Standard Deviation } (\sigma_x) = \sqrt{\frac{\sum d'^2}{N} - \left(\frac{\sum d'}{N}\right)^2} \times c$$

where $c = 5, \sum d'^2 = 94, N = 6, \sum d' = -12$

$$\therefore \quad (\sigma_X) = \sqrt{\frac{94}{6} - \left(\frac{-12}{6}\right)^2} \times 5 = \text{Rs.}17.078$$

Note: The sum of deviations taken from mean is Zero. But the sum of deviations from a value other than actual mean is not equal to zero

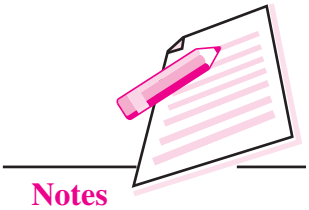
9.2.4.2 Computation of Standard Deviation in case of Continuous Series

In continuous series, the class-interval and frequencies are given. The following methods are used to compute standard deviation in this case:

1. Actual Mean Method

In this method the following steps are involved:

- Calculate the mean of the distribution.
- Estimate deviations of mid-values from the actual mean i.e. $x = m - \bar{X}$.
- Multiply the deviations with their corresponding frequencies to get 'fx'. [Note that $\Sigma fx = 0$].
- Calculate fx^2 values by multiplying 'fx' values with 'x' values and sum up these to get $\sum fx^2$.
- Apply the following formula to obtain standard deviation:



$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum fx^2}{\sum f}}$$

where $x = (m - \bar{X})$ i.e. deviation taken from the arithemetic mean $(\bar{X})$

2. Assumed Mean Method

The steps involved in the calculation of standard deviation are as follows:

- Calculate mid-points (i.e. m) of classes.
- Estimate the deviations of mid-points from the assumed mean (A) i.e. d = m – A.
- Multiply values of'd' with corresponding frequencies to get 'fd' values (note that the total of this column is not zero since deviations have been taken from assumed mean).
- Apply the following formula to calculate standard deviation:

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$$

where d = (m – A) i.e. deviation taken from the assumed mean (i.e. A)

3. Step Deviation Method

The steps involved in the calculation of standard deviation are as follows:

- Calculate class mid-points (m) and deviations (d) from an arbitrarily chosen value just like in the assumed mean method. i.e. d= m-A.
- Divide the deviations by a common factor 'C' denoted by $d' = \left(\frac{m - A}{c}\right)$.
- Multiply d′ values with corresponding f values to obtain fd′ values.
- Multiply fd′ values with d′ values to get fd'^2 values.
- Obtain $\Sigma fd'$ and $\Sigma fd'^2$ values.
- Apply the following formula.

$$\text{Standard Deviation } (\sigma_x) = \sqrt{\frac{\sum fd'^2}{\sum f} - \left(\frac{\sum fd'}{\sum f}\right)^2} \times c$$

where $d' = \left(\frac{m - A}{c}\right)$ i.e. deviation taken from the assumed mean and divide by class interval (c) (or the common factor in case the class intervals are unequal), m is the mid value of the interval.

Standard Deviation: Interesting Properties

1. The value of Standard Deviation remains same if each observation in a series is increased or decreased by a constant value i.e. Standard deviation is independent of change of origin.
2. The value of Standard Deviation changes if each of observation in a series is multiplied or divided by a constant value i.e. Standard deviation is not independent of change of scale.

Example 10: A study of 1000 companies gives the following information

Profit (in ₹ crores)	0-10	10-20	20-30	30-40	40-50	50-60
No. of Companies	10	20	30	50	40	30

Calculate the standard deviation of the profit earned.

(i) Actual Mean Method

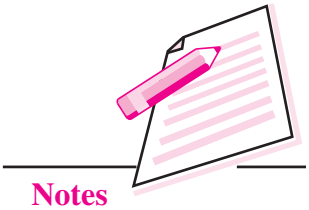
(ii) Assumed Mean Method

(iii) Step-Deviation Method

Solution:

Table 9.7: Calculation of standard deviation

Profit (in ₹ crores)	**No. of Companies**	**m**	**fm**	**d = (m – 40)**	**$d' = \frac{m - 45}{10}$**	**fd**	**fd^2**	**fd′**	**fd'^2**
0-10	10	5	50	–35	–4	–350	12250	–40	160
10-20	20	15	300	–25	–3	–500	12500	–60	180
20-30	30	25	750	–15	–2	–450	6750	–60	120
30-40	50	35	1750	–5	–1	–250	1250	–50	50
40-50	40	45	1800	5	0	200	1000	0	0
50-60	30	55	1650	15	1	450	6750	30	30
			6300	**Σd = –60**	**Σd′ = –9**	**–900**	**40500**	**–180**	**540**



Applying Actual Mean Method

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum fx^2}{\sum f}}$$

$$\sum fx^2 = 36000, \sum f = 180$$

$$\therefore (\sigma_X) = \sqrt{\frac{36000}{180}} = 14.142 \text{(in rupees crores)}$$

Applying Assumed Mean Method:

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$$

$$\sum fd^2 = 40500, \sum fd = -900, \sum f = 180, d = X - 40$$

$$\therefore (\sigma_X) = \sqrt{\frac{40500}{180} - \left(\frac{-900}{180}\right)^2} = 14.142 \text{(in rupees crores)}$$

Applying Step Deviation Method:

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum fd'^2}{\sum f} - \left(\frac{\sum fd'}{\sum f}\right)^2} \times c$$

$$d' = \frac{m - 45}{10}, \sum fd'^2 = 540, \sum fd' = -180, \sum f = 180, c = 10$$

$$\therefore (\sigma_X) = \sqrt{\frac{540}{180} - \left(\frac{-180}{180}\right)^2} \times 10 = 14.142 \text{(in rupees crores)}$$

Example 11: The following table shows the daily wages of a random sample of construction workers. Calculate its mean deviation and standard deviation.

Daily Wages (₹)	Number of Workers
200 - 399	5
400 - 599	15
600 - 799	25
800 - 999	30
1000 - 1199	18
1200 - 1399	7
Total	100

Solution:

Table 9.8: Computation of mean deviation

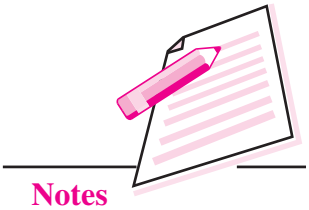
Daily Wages (₹) X	Number of Workers (f)	Class Mark (m)	fm	$f_i \lvert m - \bar{X} \rvert$ = $f_i \lvert m - 823.5 \rvert$
200 – 399	5	299.5	1497.50	2,620
400 – 599	15	499.5	7492.50	4,860
600 – 799	25	699.5	17487.50	3,100
800 – 999	30	899.5	26985.00	2,280
1000 – 1199	18	1,099.5	19791.00	4,968
1200 – 1399	7	1,299.5	9096.50	3,332
Total	100		82350.00	21,160

$$\text{Mean deviation} = \frac{\Sigma f_i \lvert m - \bar{X} \rvert}{\Sigma f_i} = \frac{21,160}{100} = 211.60 \text{ (₹)}$$

Table 9.9: Computation of Standard deviation

Daily Wages (₹)	Number of Workers	Class Mark (M.V.)	$f_i (m - \bar{X})^2$
200 – 399	5	299.5	1, 372,880
400 – 599	15	499.5	1,574,640
600 – 799	25	699.5	384,400
800 – 999	30	899.5	173,280
1000 – 1199	18	1,099.5	1,371,168
1200 – 1399	7	1,299.5	1,586,032
Total	100		6,462,400

$$\text{Standard deviation} = \sqrt{\frac{6462400}{100}} = 254.21 \text{ (Rupees)}$$



INTEXT QUESTION 9.5

1. Sona, Karina, Omar, Mustafa and Amie obtained marks of 6, 7, 3, 7, 2 on a standardized test respectively. Find the standard deviation of their scores.

9.2.4.3 Comparison of the variation of two series using standard deviation

The values of the standard deviations cannot be used as the basis of the comparison mainly because units of measurements of the two distributions may be different. The correct measure that should be used for comparison purposes is the **Coefficient of Variation (C.V.)** given by **Karl Pearson**:

$$C.V. = \frac{\sigma_X}{\bar{X}} \times 100$$

σ_X = S.D. of variable X, $\bar{X}$ = mean of variable X

Example 12: The following table shows the summary statistics for the daily wages of two types of workers.

Worker's Type	Daily Wages	
	Mean	Standard deviation
I	₹ 100	₹ 20
II	₹ 150	₹ 24

Compare these two daily wages distributions.

Solution:

Table 9.10: Calculation of coefficient of variations

In comparison	Distribution	Reason
Average magnitude	II > I	$\bar{X}_{II} = 150 > \bar{X}_I = 100$
Variation	I > II	$CV_I = \frac{20}{100} \times 100 = 20\% > CV_{II}$
		$= \frac{24}{150} \times 100 = 16\%$

INTEXT QUESTIONS 9.6

1. The hourly wages of a sample of 130 system analysts are given below:

   mean = 60 range = 20

   mode = 73 variance = 324

   median = 74

   The coefficient of variation equals

   (a) 0.30% (b). 30% (c) 5.4% (d) 54%

2. The measure of dispersion that is influenced most by extreme values is:

   (a) the standard deviation

   (b) the range

   (c) the inter-quartile range

3. The descriptive measure of dispersion that is based on the concept of a deviation about the mean is

   (a) the range (b) the inter-quartile range

   (c) the absolute value of the range (d) the standard deviation

4. The numerical value of the standard deviation can never be

   (a) zero (b) negative (c) one

5. A researcher has collected the following sample data. The mean of the sample is 5.

   3 5 12 3 2

   The Standard deviation is

   a. 8.944 b. 4.062 c. 13.2 d. 16.5

   Answer: b

   And

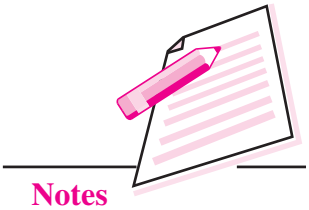
   The Coefficient of Variation is

   a. 72.66% b. 81.24% c. 264% d. 330%

   Answer: b

9.2.5 Lorenz Curve

Lorenz curve is the graphical method of studying dispersion. Lorenz curve is the cumulative frequency curve showing the distribution of a variable such as population against any independent variable such as income or area settled. If the



distribution of the dependent variable is equal, the plot will show as a straight, 45° line. Unequal distributions will yield a curve. The gap between this curve and the 45° line is the inequality gap. The farther the curve from this 45° line, the greater is the variability present in the distribution. Lorenz curve is used to see the degree of concentration of income or health. For example, it may show top 25% of population accounts for 70% of income or bottom 25% of population has only 5% of income (see figure 9.1).

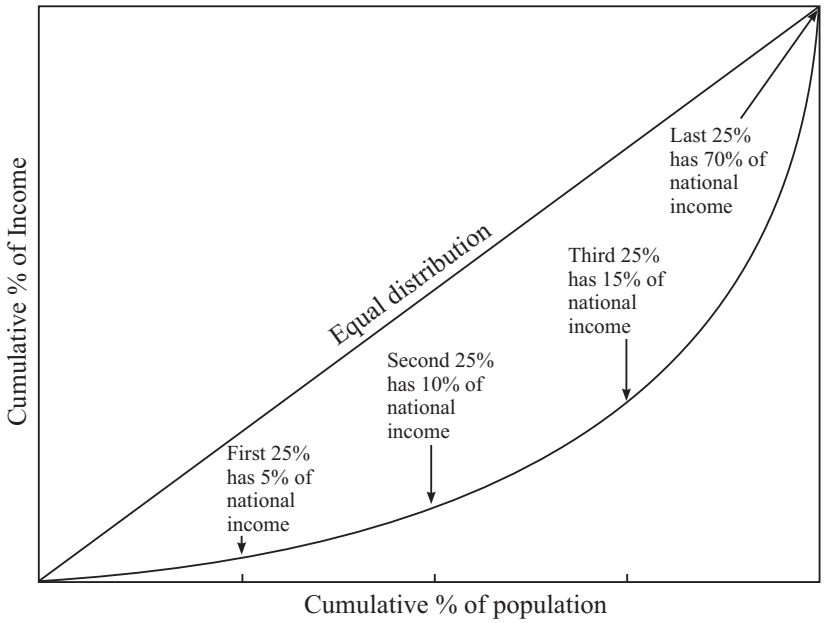

Cumulative % of Income
Equal distribution
Last 25% has 70% of national income
Third 25% has 15% of national income
Second 25% has 10% of national income
First 25% has 5% of national income
Cumulative % of population

Fig. 9.1

Steps involved in drawing Lorenz Curve:

The drawing of Lorenz curve requires following steps:

1. Find cumulative totals of variables. In case of continuous variable calculate the cumulative totals of mid-points.
2. Estimate cumulative frequencies.
3. Express the cumulative mid-points and frequencies into percentages by taking each of the sum total as 100.
4. Take the cumulative percentages of the variable on Y axis and cumulative percentages of frequencies on X-axis. Each axis will have values from '0' to '100'.
5. Draw a line joining Co-ordinate (0, 0) with (100,100). This is called the line of equal distribution.
6. Plot the cumulative percentages of the variable with corresponding cumulative percentages of frequency. Join these points to get the Lorenz Curve.

WHAT YOU HAVE LEARNT

- The important measures of dispersion are:
  - i) Range
  - ii) Quartile deviation or Semi-Inter quartile range.
  - iii) Standard deviation
  - iv) Lorenz Curve
- Range (R) is the difference between the largest (L) and the smallest value (S) in a distribution i.e. Range (R) = L – S
- The Coefficient of Range is the relative measure of the range and is given by:

$$\frac{L-S}{L+S}$$

- Quartile Deviation (Q.D) is given by $Q.D. = \frac{Q_3 - Q_1}{2}$
- The Coefficient of quartile deviation is given by Coeffof $Q.D. = \frac{Q_3 - Q_1}{Q_3 + Q_1}$
- Standard deviation is the most important and commonly used measure of dispersion It is denoted by S.D. or σ_x.
- Standard deviation in case of Individual Series is given by four methods:

(i) Actual Mean Method

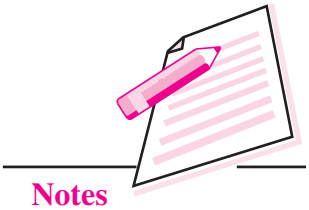
$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\Sigma (X - \bar{X})^2}{N}}$$

N = Total No. of observation

(ii) Assumed Mean Method

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\Sigma d^2}{N} - \left(\frac{\Sigma d}{N}\right)^2}$$

where d = (X – A) i.e. deviation taken from the assumed mean (A)



(iii) Direct Method

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum X^2}{N} - \left(\bar{X}\right)^2}$$

where $\bar{X}$ = arithemetic mean

(iv) Step Deviation Method

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum d'^2}{N} - \left(\frac{\sum d'}{N}\right)^2} \times c$$

where $d' = \left(\frac{X - A}{c}\right)$ i.e. deviation taken from the assumed mean and divide by class interval (c)

- Standard Deviation in case of Continuous Series is given by

(i) Actual Mean Method

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum fx^2}{\sum f}}$$

where $x = (m - \bar{X})$ i.e. deviation taken from the arithemetic mean $(\bar{X})$

(ii) Assumed Mean Method

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$$

where d = (m – A) i.e. deviation taken from the assumed mean (i.e. A)

(iii) Step Deviation Method

$$\text{Standard deviation } (\sigma_x) = \sqrt{\frac{\sum fd'^2}{\sum f} - \left(\frac{\sum fd'}{\sum f}\right)^2} \times c$$

where $d' = \left(\frac{m - A}{c}\right)$ i.e. deviation taken from the assumed mean and divide by class interval (c) (or the common factor in case the class intervals are unequal, m is the mid value of the interval.

- Standard deviation is independent of change of origin but not independent of change of scale.
- The coefficient of variation (C.V.) is the relative measure of dispersion which is used for the comparison of variability of two or more distributions. It is given by:

$$C.V. = \frac{\sigma_X}{\bar{X}} \times 100$$

σ_X = S.D. of variable X, $\bar{X}$ = mean of variable X

- Lorenz curve is the graphical method of estimating dispersion.

TERMINAL EXERCISES

Range

1. The following are the prices of shares of A B Co. Ltd. from Monday to Saturday:

Days	Price (in ₹)	Days	Price (in ₹)
Monday	200	Thursday	160
Tuesday	210	Friday	220
Wednesday	208	Saturday	250

Calculate range and its coefficient

2. Find the range of given data

108, 107, 105, 106, 107, 104, 103, 101, 104

3. Find the value of range of frequency distribution

Age in years:	14	15	16	17	18	19	20
No. of students :	1	2	2	2	6	4	0

4. Calculate the range for the distribution given below

Height in cms	150	151	152	154	159	160	165	166
No. of Boys	2	2	9	15	18	10	4	1

5. Find the range of the following data

Profit (in '000 ₹):	0-10	10-20	20-30	30-40	40-50
No. of firms	0	6	0	7	15

6. Find the range of the following distribution

Class Interval	10-20	20-30	30-40	40-50	50-60
Frequency	8	10	15	18	19

Quartile Deviation

7. Calculate the QD for a group of data,

241, 521, 421, 250, 300, 365, 840, 958

8. From the following figures find the quartile deviation and its coefficient:

Height (cms.):	150	151	152	153	154	155	156	157	158
No. of Students:	15	20	32	35	33	22	20	12	10

9. Using quartile deviation, state which of the two variables – A and B is more variable:

A		B	
Mid-Point	**Frequency**	**Mid-Point**	**Frequency**
15	15	100	340
20	33	150	492
25	56	200	890
30	103	250	1420
35	40	300	620
40	32	350	360
45	10	400	187
		450	140

10. Find the quartile deviation from the following table:

Size:	4-8	8-12	12-16	16-20	20-24	24-28	28-32	32-36	36-40
Frequency:	6	10	18	30	15	12	10	6	2

11. Calculate the coefficient of quartile deviation from the following data:

Class Interval	Frequency
10–15	4
15–20	12
20–25	16
25–30	22
30–40	10
40–50	8
50–60	6
60–70	4
	8

Standard deviation

12. Determine the standard deviation of the following student test results percentages.

92% 66% 99% 75% 69% 51% 89% 75% 54% 45% 69%

13. Calculate the coefficient of variation for the following data set.

The price (in ₹), of a stock over five trading days was 52, 58, 55, 57, 59.

14. The frequency table of the monthly salaries of 20 people is shown below.

Salary (in ₹)	Frequency
3500	5
4000	8
4200	5
4300	2

(a) Calculate the mean of the salaries of the 20 people.

(b) Calculate the standard deviation of the salaries of the 20 people.

15. The following table shows the grouped data, in classes, for the heights of 50 people.

Height (in cm) – classes	Frequency
$120 \leq 130$	2
$130 \leq 140$	5
$140 \leq 150$	25
$150 \leq 160$	10
$160 \leq 170$	8

a) Calculate the mean of the salaries of the 50 people.

b) Calculate the standard deviation of the salaries of the 50 people.

16. The following is the frequency distribution for the speeds of a sample of automobiles traveling on an interstate highway.

Speed Miles per Hour	Frequency
50 – 54	2
55 – 59	4
60 – 64	5
65 – 69	10
70 – 74	9
75 – 79	5
	35

Calculate the mean, and the standard deviation of speed.

17. In 2012, the average age of workers in a company was 22 with a standard deviation of 3.96. In 2013, the average age was 24 with a standard deviation of 4.08. In which year do the ages show a more dispersed distribution? Show your complete work and support your answer.

Therefore the year 2012 shows a more dispersed distribution.

18. The following is a frequency distribution for the ages of a sample of employees at a local company.

Age (in years)	Frequency
30 – 39	2
40 – 49	3
50 – 59	7
60 – 69	5
70 – 79	1

(a) Determine the average age for the sample.

(b) Compute the standard deviation.

(c) Compute the coefficient of variation.

19. The population change between 1990 and 2000 for several small cities are shown below.

City	Population Change (number of residents)
A	3083
B	1466
C	-461
D	1113
E	-11
F	395
G	3290
H	437

For the above **sample**, determine the following measures.

(a) The mean

(c) The standard deviation

(d) The median

ANSWERS TO INTEXT QUESTIONS

9.1

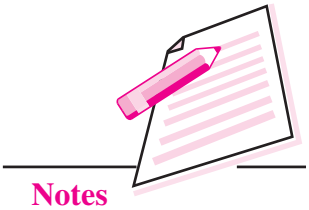
1. (c)
2. (c)

9.2

1. 140

9.3

1. (c)
2. (d)
3. (c)
4. (b)



9.4

1. Median = 5, M.D. = 1.68
2. M.D. 0.915, Coefficient of M.D. = 0.336

9.5

1. 2.1 marks

9.6

1. (b)
2. (b)
3 (d)
4. (b)
5. Standard deviation (b) C.V

Notes

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10

CORRELATION ANALYSIS

In previous lessons you have learnt how to summarize the mass of data and variations in the similar variable. Many a time, we come across situations which involve the study of association among two or more variables. For example we may find that there is some relationship between the two variables such as amount of rain fall and production of wheat; figures of accidents and number of motor cars in a city; money spent on advertising and sales. On the other hand, if we compare the figures of rainfall in India and the production of cars in Japan, we may find that there is no relationship between the two variables. If there is any relation between two variables i.e. when one variable changes the other also changes in the same or in the opposite direction, we say that the two variables are correlated.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning of the term correlation;
- explain the relationship between two variables;
- calculate the different measures of correlation; and
- analyze the degree and direction of the relationships.

10.1 MEANING OF CORRELATION

Correlation refers to the associations between variables. When an association exists between two variables, it means that the average value of one variable changes as there is a change in the value of the other variable. A correlation is the simplest type of association. When a correlation is weak, it means that the average value of one variable changes only slightly (only occasionally) in response to changes in the other variable. If there is no association, it means that there is no

change in the value of one variable in response to the changes in the other variable. In some cases, the correlation may be positive or it may be negative. A positive correlation means that as one variable increases the other variable increases, e.g. Height of a child and age of the child. Negative correlation implies as one variable increases the other variable decrease, e.g. value of a car and age of the car.

10.2 CORRELATION AND CAUSATION

The correlation between two variables measures the strength of the relationship between them but it doesn't indicate the cause and effect relationship between the variables. Correlation measures co-variation, not causation. Causation means changes in one variable affects/ causes the changes in other variable. In other words, just because two events or things occur together does not imply that one is the cause of the other. A positive "linear" correlation between two variables say X and Y implies that high values of X are associated with high values of Y, and that low values of X are associated with low values of Y. It does not imply that X causes Y. for example, a high degree of positive correlation may be obtained between the size of arms of children and their reasoning ability i.e. children with longer arms reason better than those with shorter arms, but there is no causal connection here. Children with longer arms reason better because they're older! In this example the common third factor 'age' is responsible for the high correlation between size of arms and reasoning ability. This refers to spurious correlation. Similarly a Researcher found a high degree of positive correlation between the number of temple goers and the number of burglaries committed in different towns. An explanation that more temple goers means more empty houses or attending temple makes people want to rob would be a logical fallacy. Instead the third factor population is causing this relationship. The highly populated area tends to have more temple goers and also case of burglaries. The following table 11.1 provides some interesting examples of influence of third variable on correlation between variables.

Table 10.1: Spurious Correlation and Influence of Third Variable.

Observed Spurious Correlation	Influence of Third Variable.
Positive Correlation between Amount of ice cream sold and deaths by drowning at the beach during summer.	**Summer Season:** Ice cream sales and drowning tend to be high during the warm months of the year.
Shoe size and reading performance for elementary school children.	**Age:** Older children have larger shoe sizes and read better.
Number of doctors in region and number of people dying from disease.	**Population density:** In highly dense areas, there are more doctors and more people die.

Number of police officers and number of crimes.	**Population density:** In highly dense areas, there are more police officers and more crimes.
Teachers' salaries and the price of vegetables.	**Time:** Both tend to increase over time.

Further, It is found that there is a positive and a high degree of correlation between the amount of oranges imported and road accidents i.e. as the amount of imported oranges increases, so do the traffic fatalities. However, it is fairly obvious just from logical thought that there is likely to be no causal relationship between the two. That is, the importing of oranges does not cause traffic fatalities. Conversely, if we stopped importing oranges, we would not expect the number of traffic fatalities to decline. It may be a sheer coincidence that a high degree of correlation is obtained between them.

10.3 TYPES OF CORRELATION

Correlation may be:

1. Positive and negative correlation
2. Linear and non-linear correlation

A) If two variables change in the same direction (i.e. if one increases the other also increases, or if one decreases, the other also decreases), then this is called a **positive correlation.** For example: Advertising and sales.

Some other examples of series of positive correlation are:

(i) Heights and weights;

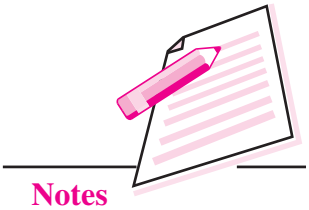
(ii) Household income and expenditure;

(iii) Price and supply of commodities;

(iv) Amount of rainfall and yield of crops.

INTEXT QUESTIONS 10.1

1. It has been noted that there is a positive correlation between the I.Q. level and the size of women's shoes. With smaller size of shoes of women corresponds to lower intelligence level and higher size of shoes of women corresponds to higher intelligence level of women. Comment on the conclusion that economic factors cause hemlines to rise and fall.



2. A researcher has a large number of data pairs (age, height) of humans beings from birth to 70 years. He computes a correlation coefficient. Would you expect it to be positive or negative? Why?

B) **If two variables change in the opposite direction** (i.e. if one increases, the other decreases and vice versa), then the correlation is called a **negative correlation.** For example: T.V. registrations and cinema attendance.

Some other examples of series of negative correlation are:

(i) Volume and pressure of perfect gas;

(ii) Current and resistance [keeping the voltage constant]

(iii) Price and demand for goods.

INTEXT QUESTIONS 10.2

1. What sort of correlation would be expected between a company's expenditure on health and safety and the number of work related accidents.
   (a) positive
   (b) negative
   (c) none
   (d) infinite

2. When "r" is negative, one variable increases in value, …..
   (a) the other increases
   (b) the other increases at a greater rate
   (c) the other variable decreases in value
   (d) there is no change in the other variable
   (e) all of the above

10.4 LINEAR AND NON-LINEAR CORRELATION

The nature of the graph gives us the idea of the linear type of correlation between two variables. If the graph is in a straight line, the correlation is called a **"linear correlation"** and if the graph is not in a straight line, the correlation is **non-linear** or **curvi-linear.**

For example, if variable x changes by a constant quantity, say 20 then y also changes by a constant quantity, say 4. The ratio between the two always remains the same (1/5 in this case). In case of a curvi-linear correlation this ratio does not remain constant.

Notes

In general two variables x and y are said to be linearly related, if there exists a relationship of the form

$$y = a + bx$$

where 'a' and 'b' are real numbers. This is nothing but a straight line when plotted on a graph sheet with different values of x and y and for constant values of a and b. Such relations generally occur in physical sciences but are rarely encountered in economic and social sciences.

The relationship between two variables is said to be non – linear if corresponding to a unit change in one variable, the other variable does not change at a constant rate but changes at a fluctuating rate. In such cases, if the data is plotted on a graph sheet we will not get a straight line curve. For example, one may have a relation of the form

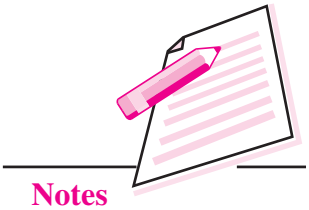
$$y = a + bx + cx^2$$

10.5 DEGREES OF CORRELATION

Through the coefficient of correlation, we can measure the degree or extent of the correlation between two variables. On the basis of the coefficient of correlation we can also determine whether the correlation is positive or negative and also its degree or extent.

1. **Perfect correlation:** If two variables change in the same direction and in the same proportion, the correlation between the two is perfect positive. According to Karl Pearson the coefficient of correlation in this case is +1. On the other hand, if the variables change in the opposite direction and in the same proportion, the correlation is perfect negative. Its coefficient of correlation is -1. In practice we rarely come across these types of correlations.
2. **Absence of correlation:** If two series of two variables exhibit no relations between them or change in one variable does not lead to a change in the other variable, then we can firmly say that there is no correlation or absurd correlation between the two variables. In such a case the coefficient of correlation is 0.
3. **Limited degrees of correlation:** If two variables are not perfectly correlated or there is a perfect absence of correlation, then we term the correlation as Limited correlation.

Thus Correlation may be positive, negative or zero but lies with the limits ± 1. i.e. the value of r is such that $-1 \leq r \leq +1$. The + and – signs are used for positive linear correlations and negative linear correlations, respectively.



- If x and y have a strong positive linear correlation, r is close to +1. An r value of exactly +1 indicates a perfect positive correlation.
- If x and y have a strong negative linear correlation, r is close to -1. An r value of exactly -1 indicates a perfect negative correlation
- If there is no linear correlation or a weak linear correlation, r is close to 0.

The following Table reveals the effect (or degree) of coefficient of correlation.

Table 10.2: Degree and Type of Correlation

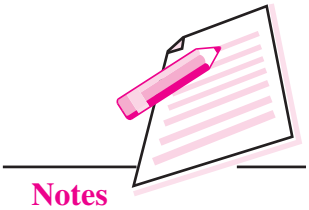
Degrees	Positive	Negative
Absence of correlation →	Zero	Zero
Perfect correlation →	+ 1	–1
High degree →	+ 0.75 to + 1	– 0.75 to –1
Moderate degree →	+ 0.25 to + 0.75	– 0.25 to – 0.75
Low degree →	0 to 0.25	0 to – 0.25

Note that r is a dimensionless quantity; that is, it does not depend on the units employed

INTEXT QUESTIONS 10.3

1. The coefficient of correlation ranges between
   (a) 0 and 1
   (b) –1 and +1
   (c) minus infinity and plus infinity
   (d) 1 and 100
2. If two variables are absolutely independent of each other the correlation between them must be,
   (a) –1
   (b) 0
   (c) +1
   (d) +0.1
3. The coefficient of correlation:
   (a) can be larger than 1
   (b) cannot be larger than 1
   (c) cannot be negative

4. If height is independent of average yearly income, what is the predicted correlation between these two variables?
   (a) 1
   (b) –1
   (c) 0
   (d) Impossible to say for sure
5. A student produces a correlation of +1.3. This is
   (a) a high positive correlation
   (b) a significant correlation
   (c) an impossible correlation
   (d) only possible if N is large
6. If A scored the top mark in the apprentices test on computing and the correlation between that test and the test on English language was +1.0 what position did A get in the test on English language.
   (a) middle
   (b) bottom
   (c) top
   (d) cannot say from the information given
7. Which correlation is the strongest +0.65 or –0.70
   (a) –0.70
   (b) +0.65
   (c) depends on N
   (d) cannot say from the information given
7. The symbol for the Karl Pearson Correlation Co-efficient is
   (a) Σ (b) σ (c) α (d) r
8. For a normal good, if price increases then the quantity demanded decreases. What type of correlation co-efficient would you expect in this situation?
   (a) 0
   (b) positive
   (c) 0.9
   (d) negative
   (e) unknowable



10.6 PROPERTIES OF CORRELATION COEFFICIENT

1. The correlation coefficient 'r' lies between -1 to +1.
2. The correlation coefficient 'r' is the pure number and is independent of the units of measurement of the variables.
3. The correlation coefficient 'r' is independent of change of origin i.e. the value of r is not affected even if each of the individual value of two variables is increased or decreased by some non-zero constant.
4. The correlation coefficient 'r' is independent of change of scale i.e. the value of r is not affected even if each of the individual value of two variables is multiplied or divided by some non-zero constant.

INTEXT QUESTIONS 10.4

1. Given a set of paired data (X, Y)
   (a) If Y is independent of X, then what value of a correlation coefficient would you expect?
   (b) If Y is linearly dependent on X, then what value of a correlation coefficient would you expect?
2. State whether the following statement is true or false: "If a positive correlation exists between height and weight, a person with above average height is expected to have above average weight".

10.7 METHODS OF DETERMINING CORRELATION

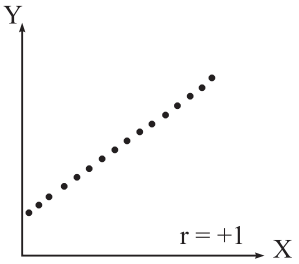
We shall consider the following most commonly used methods.

1. Scatter Plot
2. Karl Pearson's coefficient of correlation
3. Spearman's Rank-correlation coefficient.

10.7.1 Scatter Plot (Scatter diagram or dot diagram)

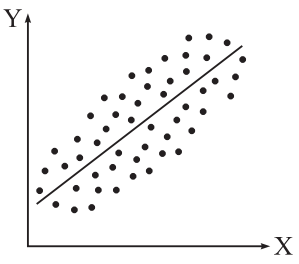
Scatter Plots (also called scatter diagrams) are used to graphically investigate the possible relationship between two variables without calculating any numerical value. In this method, the values of the two variables are plotted on a graph paper. One is taken along the horizontal (X-axis) and the other along the vertical (Y-axis). By plotting the data, we get points (dots) on the graph which are generally scattered and hence the name 'Scatter Plot'.

The manner in which these points are scattered, suggest the degree and the direction of correlation. The degree of correlation is denoted by 'r' and its direction is given by the signs positive and negative.



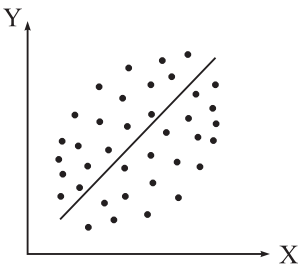
Perfect Positive Correlation

(a)



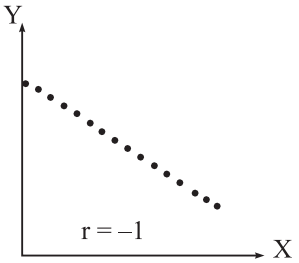
High Degree of Positive Correlation

(b)



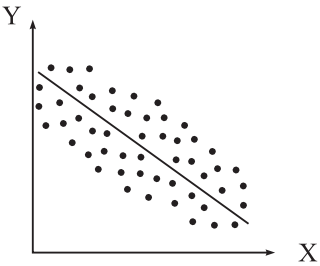
Low Degree of Positive Correlation

(c)



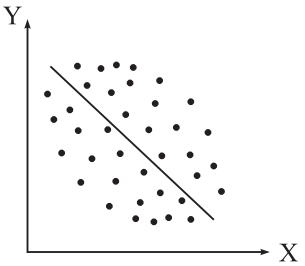
Perfect Negative Correlation

(d)



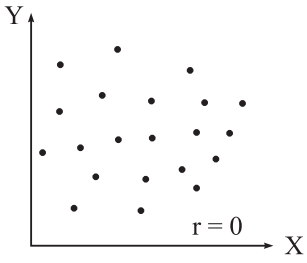
High Degree of Negative Correlation

(e)



Low Degree of Negative Correlation

(f)



No Correlation

(g)

(i) If all points lie on a rising straight line, the correlation is perfectly positive and r = +1 (see fig. a)

(ii) If all points lie on a falling straight line the correlation is perfectly negative and r = -1 (see fig. d)

(iii) If the points lie in narrow strip, rising upwards, the correlation is high degree of positive (see fig. b)

(iv) If the points lie in a narrow strip, falling downwards, the correlation is high degree of negative (see fig. e)

(v) If the points are spread widely over a broad strip, rising upwards, the correlation is low degree positive (see fig. c)

(vi) If the points are spread widely over a broad strip, falling downward, the correlation is low degree negative (see fig. f)

(vii) If the points are spread (scattered) without any specific pattern, the correlation is absent. i.e. r = 0. (see fig. g)

Though this method is simple and is a rough idea about the existence and the degree of correlation, it is not reliable. As it is not a mathematical method, it cannot measure the degree of correlation.

10.7.2 Karl Pearson's coefficient of correlation

It gives the precise numerical expression for the measure of correlation. It is denoted by 'r'. The value of 'r' gives the magnitude of correlation and its sign denotes its direction. The mathematical formula for computing r is:

$$r = \frac{\sum xy}{N\sigma_X\sigma_y} \qquad ...(1)$$

where $x = (X - \bar{X})$, $y = (Y - \bar{Y})$, σ_X = s.d. of X

σ_y = s.d. of Y

and N = number of paris of observations

Since $\sigma_X = \sqrt{\frac{\sum x^2}{N}}$ and $\sigma_y = \sqrt{\frac{\sum y^2}{N}}$

So equation 1 can be rewritten as:

$$r = \frac{\sum xy}{\sqrt{\sum x^2} \times \sqrt{\sum y^2}}$$

By using actual mean

$$r = \frac{\Sigma(X-\bar{X})\times(Y-\bar{Y})}{\sqrt{\Sigma(X-\bar{X})^2}\times\sqrt{\Sigma(Y-\bar{Y})^2}} \quad ...(2)$$

By assumed mean method

$$r = \frac{\Sigma dxdy - \frac{\Sigma dx \cdot \Sigma dy}{N}}{\sqrt{\Sigma dx^2 - \frac{(\Sigma dx)^2}{N}}\times\sqrt{\Sigma dy^2 - \frac{(\Sigma dy)^2}{N}}} \quad ...(3)$$

By direct method

$$r = \frac{N\Sigma XY - [\Sigma X][\Sigma Y]}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\times\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}} \quad ...(4)$$

Now covariance of X and Y is defined as

$$cov(X,Y) = \frac{\Sigma(X_i-\bar{X})(Y_i-\bar{Y})}{N}$$

$$\therefore \quad r = \frac{cov(X,Y)}{\sigma_X\sigma_Y}$$

Where N is the number of pairs of data.

$$d_x = X - A_X$$
$$d_y = Y - A_Y$$

INTEXT QUESTIONS 10.5

1. Positive values of covariance indicate
   (a) a positive variance of the X values
   (b) a positive variance of the Y values
   (c) the standard deviation is positive
   (d) positive relation between two variables

Example 1: Calculate the coefficient of correlation between the expenditure on advertising and sales of the company from the following data.

Advertising Expenditure (in 000 ₹):	165	166	167	168	167	169	170	172
Sales (in Lakh ₹)	167	168	165	172	168	172	169	171

Solution: N = 8 (pairs of observations)

Table 10.3: Calculation of coefficient of correlation

Advertising Expenditure (in 000 ₹) : X_i	Sales (in Lakh ₹) Y_i	$x = X_i - \bar{X}$	$y = Y_i - \bar{Y}$	xy	x^2	y^2
165	167	–3	–2	6	9	4
166	168	–2	–1	2	4	1
167	165	–1	–4	4	1	16
167	168	–1	–1	1	1	1
168	172	0	3	0	0	9
169	172	1	3	3	1	9
170	169	2	0	0	4	0
172	171	4	2	8	16	4
$\Sigma X_i = 1344$	$\Sigma Y_i = 1352$	0	0	$\Sigma xy = 24$	$\Sigma x^2 = 36$	$\Sigma y^2 = 44$

Calculation:

$$\bar{X} = \frac{\Sigma X_i}{N} = \frac{1344}{8}$$

$$= 168 \text{ cm and } \sigma_x = \sqrt{\frac{\Sigma x^2}{N}} = \sqrt{\frac{36}{8}}$$

$$\bar{Y} = \frac{\Sigma Y_i}{N} = \frac{1352}{8}$$

$$= 169 \text{ cm and } \sigma_y = \sqrt{\frac{\Sigma y^2}{N}} = \sqrt{\frac{44}{8}}$$

Now, $$r = \frac{\Sigma xy}{N\sigma_x\sigma_y} = \frac{24}{8\sqrt{\frac{36}{8}} \times \sqrt{\frac{44}{8}}} = \frac{24}{\sqrt{36 \times 44}} = +0.6029$$

Since r is positive and 0.6. This shows that the correlation is positive and moderate (i.e. direct and reasonably good).

Example 2: From the following data compute the coefficient of correlation between X and Y.

		X	Y
No. of items	→	15	15
Arithmetic mean	→	25	18
$\Sigma(X_i - \bar{X})^2$ and $\Sigma(Y_i - \bar{Y})^2$	→	136	138
$\Sigma(X_i - \bar{X}) \cdot \Sigma(Y_i - \bar{Y})$	→	122	

Solution: Given, N = 15, $\bar{X} = 25$. $\bar{Y} = 18$

$$\Sigma(X_i - \bar{X})^2 \quad \text{i.e.} \quad \Sigma x^2 = 136$$

$$\Sigma(Y_i - \bar{Y})^2 \quad \text{i.e.} \quad \Sigma y^2 = 138$$

and $$\Sigma(X_i - \bar{X}) \cdot \Sigma(Y_i - \bar{Y}) = \Sigma xy = 122$$

Using $$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2} \times \sqrt{\Sigma y^2}}$$

we get $$r = \frac{122}{\sqrt{136} \times \sqrt{138}} = \frac{122}{136.9} = 0.891$$

Example 3: If covariance between X and Y is 12.3 and the variance of x and y are 16.4 and 13.8 respectively. Find the coefficient of correlation between them.

Solution: Given: Covariance = cov (X, Y) = 12.3

Variance of X (σ_x^2) = 16.4

Variance of Y (σ_y^2) = 13.8

Now,

$$r = \frac{\text{cov}(X, Y)}{\sigma_x \sigma_y} = \frac{12.3}{\sqrt{16.4} \times \sqrt{13.8}}$$

$$= \frac{12.3}{4.05 \times 3.71} = 0.82$$

Example 4: Find the number of pair of observations from the following data.

$r = 0.25, \Sigma(X_i - X)(Y_i - Y) = 60, \sigma_y = 4, \Sigma(X_i - \bar{X})2 = 90.$

Solution: Given: $r = 0.25$

$$\Sigma\left(X_i - \bar{X}\right)\left(Y_i - \bar{Y}\right) = \Sigma xy = 60$$

$$\sigma_x = \sqrt{\frac{\Sigma x^2}{N}} = \sqrt{\frac{\Sigma\left(X_i - \bar{X}\right)^2}{N}} = \sqrt{\frac{90}{N}}$$

$$\sigma_y = 4 = \sqrt{\frac{\Sigma y^2}{N}}$$

Now, $$r = \frac{\Sigma xy}{n\sigma_x \cdot \sigma_y} = \frac{60}{N\sqrt{\frac{90}{N}} \times 4} = \frac{15}{\sqrt{90N}}$$

$\therefore$ $$0.25 = \frac{15}{\sqrt{90N}}$$

$\therefore$ $$0.25 \times \sqrt{90N} = 15$$

on squaring

$\therefore$ $0.0625 \times 90N = 225$

$\therefore$ $$90N = \frac{225}{0.0625}$$

$\therefore$ $90N = 3600$

$\therefore$ $N = 40$

Therefore, the number of pairs of observations = 40

10.7.2.1 Assumed Mean Method (Step Deviation)

If the values of X and Y are very big, the calculation becomes very tedious and if we change the variable X to $u = \frac{X_1 - A}{h}$ and Y to $v = \frac{Y_1 - B}{k}$ where A and B are the assumed means for variable X and Y respectively and h and k are common

factor of variable X and Y, As stated earlier the one of the property of correlation coefficient is that it is independent of change of origin and change of scale so

$$r_{xy} = r_{uv}$$

The formula for r can be simplified as

$$r_{xy} = r_{uv} = \frac{\Sigma uv - \left(\frac{(\Sigma u)(\Sigma v)}{N}\right)}{\sqrt{\Sigma u^2 - \frac{(\Sigma u)^2}{N}} \times \sqrt{\Sigma v^2 - \frac{(\Sigma v)^2}{N}}}$$

Example 5: The following data relates to the Cost and Sales of a Company for the past 10 months

Cost (in 000 ₹):	44	80	76	48	52	72	68	56	60	64
Sales(in 000 ₹):	48	75	54	60	63	69	72	51	57	66

Find the coefficient of correlation between the two.

Solution: Here A = 60, h = 4, B = 60 and k = 3

Table 10.4: Correlation coefficient between cost and sales

Cost (in 000 ₹)	**Sales (in 000 ₹)**	**$u = \frac{X_1 - A}{h}$**	**$v = \frac{Y_1 - B}{d}$**	**uv**	**u^2**	**v^2**
44	48	–4	–4	16	16	16
80	75	5	5	25	25	25
76	54	4	–2	–8	16	4
48	60	–3	0	0	9	0
52	63	–2	1	–2	4	1
72	69	3	3	9	9	9
68	72	2	4	8	4	16
56	51	–1	–3	3	1	9
60	57	0	–1	0	0	1
64	66	1	2	2	4	4
		$\Sigma u = 5$	$\Sigma v = 5$	$\Sigma uv = 53$	$\Sigma u^2 = 85$	$\Sigma v^2 = 85$

Calculation:

$$r_{xy} = r_{uv} = \frac{\Sigma uv - \left(\frac{(\Sigma u)(\Sigma v)}{N}\right)}{\sqrt{\Sigma u^2 - \frac{(\Sigma u)^2}{N}} \times \sqrt{\Sigma v^2 - \frac{(\Sigma v)^2}{N}}}$$

$$= \frac{53 - \left(\frac{(5)(5)}{10}\right)}{\sqrt{85 - \frac{(5)^2}{10}} \times \sqrt{85 - \frac{(5)^2}{10}}}$$

$$= \frac{53 - \left(\frac{(5)(5)}{10}\right)}{\sqrt{85 - \frac{(5)^2}{10}} \times \sqrt{85 - \frac{(5)^2}{10}}}$$

$$= \frac{53 - 2.5}{\sqrt{82.5} \times \sqrt{82.5}}$$

$$= \frac{50.5}{82.5} = 0.61$$

10.6.3 Spearman's Rank Correlation Coefficient

This method is based on the ranks of the items rather than on their actual values. The advantage of this method over the others in that it can be used even when the actual values of items are unknown. For example if you want to know the correlation between honesty and wisdom of the boys of your class, you can use this method by giving ranks to the boys. It can also be used to find the degree of agreements between the judgments of two examiners or two judges. The formula is:

$$R = 1 - \frac{6\Sigma D^2}{N\left(N^2 - 1\right)}$$

where R = Rank correlation coefficient

D = Difference between the ranks of two items

N = the number of observations.

Note: $-1 \le R \le 1$.

(i) When $R = +1 \Rightarrow$ Perfect positive correlation or complete agreement in the same direction

(ii) When $R = -1 \Rightarrow$ Perfect negative correlation or complete agreement in the opposite direction.

(iii) When $R = 0 \Rightarrow$ No Correlation.

Computation:

(i) Give ranks to the values of items. Generally the item with the highest value is ranked 1 and then the others are given ranks 2, 3, 4 ... according to their values in the decreasing order.

(ii) Find the difference $D = R_1 - R_2$

where R_1 = Rank of X and R_2 = Rank of Y

Note that $\Sigma D = 0$ (always)

(iii) Calculate D^2 and then find ΣD^2

(iv) Apply the formula.

Note :

In some cases, there is a tie between two or more items. For example if each item have rank say 4th then they are given $\frac{4+5}{2} = 4.5$th rank. If three items are of equal rank say 4th then they are given $\frac{4+5+6}{3} = 5$th rank each. If m be the number of items of equal ranks, the factor $\frac{1}{12}(m^3 - m)$ is added to SD^2. If there is more than one of such cases then this factor added as many times as the number of such cases, then

$$R = 1 - \frac{6\left\{\Sigma D^2 + \frac{1}{12}\left(m_1^3 - m_1\right) + \frac{1}{12}\left(m_2^3 - m_2\right) + \ldots\right\}}{N\left(N^2 - 1\right)}$$

Example 6 : Calculate ' R ' from the following data.

Student No. :	1	2	3	4	5	6	7	8	9	10
Rank in Maths :	1	3	7	5	4	6	2	10	9	8
Rank in Stats :	3	1	4	5	6	9	7	8	10	2

Solution:

Table 10.5: Calculation of rank correlation

Student No.	Rank in Maths (R_1)	Rank in Stats (R_2)	$D = (R_1 - R_2)$	D^2
1	1	3	–2	4
2	3	1	2	4
3	7	4	3	9
4	5	5	0	0
5	4	6	–2	4
6	6	9	–3	9
7	2	7	–5	25
8	10	8	2	4
9	9	10	–1	1
10	8	2	6	36
N = 10			$\Sigma D = 0$	$\Sigma D^2 = 96$

Calculation of R :

$$R = 1 - \frac{6\Sigma D^2}{N\left(N^2 - 1\right)} = 1 - \frac{6(96)}{10(100-1)} = 1 - \frac{6\times 96}{10\times 99} = 0.4181$$

Example 7: Calculate 'R' of 6 students from the following data.

Marks in Stats :	40	42	45	35	36	39
Marks in English :	46	43	44	39	40	43

Solution:

Table 10.6: Calculation of rank correlation

Marks in Stats	R_1	Marks in English	R_2	D	D^2
40	3	46	1	2	4
42	2	43	3.5	–1.5	2.25
45	1	44	2	–1	1
35	6	39	6	0	0
36	5	40	5	0	0
39	4	43	3.5	0.5	0.25
N = 6				$\Sigma D = 0$	$\Sigma D^2 = 750$

Here m = 2 since in series of marks in English of items of values 43 repeated twice.

$$R = 1 - \frac{6\left\{\Sigma D^2 + \frac{1}{12}\left(2^3 - 2\right)\right\}}{N\left(N^2 - 1\right)} = 1 - \frac{6\left\{7.5 + \frac{1}{12}(8-2)\right\}}{6(36-6)}$$

$$R = 1 - \frac{6(7.5+0.5)}{210} = 0.771$$

Example 8: The value of Spearman's rank correlation coefficient for a certain number of pairs of observations was found to be 2/3. The sum of the squares of difference between the corresponding rnarks was 55. Find the number of pairs.

Solution: We have

$$1 - \frac{6\Sigma D^2}{N\left(N^2 - 1\right)} \text{ but } R = \frac{2}{3} \text{ and } \Sigma D^2 = 55$$

$$\therefore \quad \frac{2}{3} = 1 - \frac{6\times 55}{N\left(N^2 - 1\right)}$$

$$\therefore \quad -\frac{1}{3} = -\frac{6\times 55}{N\left(N^2 - 1\right)}$$

$$\therefore \quad N(N^2 - 1)\ 6 \times 55$$

Now $N(N^2 - 1) = 990$

$\therefore$ $N(N^2 - 1) = 10 \times 99 = 10(100 - 1)$

$\therefore$ $N(N^2 - 1) = 10(102 - 1) \Rightarrow N = 10$

Therefore, there were 10 students.

INTEXT QUESTIONS 10.6

1. The marks awarded by two judges in a certain beauty contest are given below:

Judge I	56	75	45	71	61	64	58	80	76	61
Judge II	66	70	40	60	65	56	59	77	67	63

By Using Rank correlation method, Determine whether the two judges have common taste in the judgement of beauty?

WHAT YOU HAVE LEARNT

- Correlation measures the associations between variables. Correlation can be positive or negative and linear or non-linear. It is denoted by r.
- The value of r lies between -1 and +1 i.e. $-1 \le r \le +1$.
- The correlation coefficient 'r' is independent of change of origin and change of scale.
- The important methods of measuring correlation are (i) Scatter Plot (ii) Karl Pearson's coefficient of correlation; and (iii) Spearman's Rank-correlation coefficient;
- Scatter Plots are used to graphically investigate the possible relationship between two variables without calculating of any numerical value.
- The mathematical formula for computing *r* using Karl Pearson method is given:

$$r = \frac{\sum xy}{N\sigma_X\sigma_y} \qquad ...(1)$$

where $x = (X - \bar{X})$, $y = (Y - \bar{Y})$, σ_X = s.d. of X

σ_X = s.d. of Y and N = number of paris of observation

- Correlation (r) can also be calculated using actual figure of two variables X and Y as follows:

$$r = \frac{N\sum XY - [\sum X][\sum Y]}{\sqrt{N\sum X^2 - (\sum X)^2} \times \sqrt{N\sum Y^2 - (\sum Y)^2}}$$

- The covariance 'of two variables say X and Y is defined as:

$$\text{cov}(X, Y) = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{N}$$

where N is the number of pairs of data.

If covariance is given, then $r = \frac{cov(X, Y)}{\sigma_X \sigma_Y}$

- The correlation (r) using Assumed Mean Method is given by:

$$r_{xy} = r_{uv} = \frac{\Sigma uv - \left(\frac{(\Sigma u)(\Sigma v)}{N}\right)}{\sqrt{\Sigma u^2 - \frac{(\Sigma u)^2}{N}} \times \sqrt{\Sigma v^2 - \frac{(\Sigma v)^2}{N}}}$$

where $u = \frac{X - A}{h}$ and $v = \frac{Y - B}{k}$

A and B are the assumed means for variable X and Y respectively and h and k are common factor of variable X and Y.

- The Spearman rank correlation (R) is given by:

$$R = 1 - \frac{6\Sigma D^2}{N\left(N^2 - 1\right)}$$

where R = Rank correlation coefficient

D = Difference between the ranks of two items

N = the number of observations.

TERMINAL EXERCISES

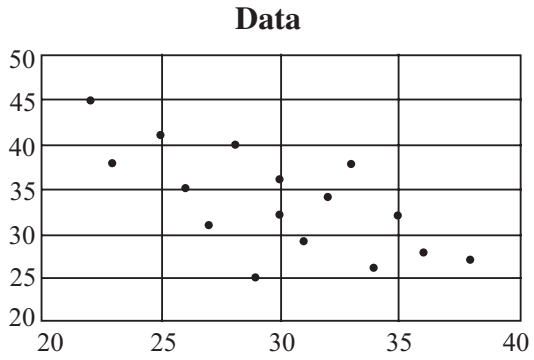
1. The data relating to variable X and Y is given below:

X	72	73	75	76	77	78	79	80	80	81	82	83	84	85	86	88
Y	45	38	41	35	31	40	25	32	36	29	34	38	26	32	28	27

(a) Sketch a scatter plot.

(b) Compute the correlation coefficient, r.

Answer 1: a.



2. Calculate and analyze the correlation coefficient between the number of study hours and the number of sleeping hours of different students.

Number of Study hours	2	4	6	8	10
Number of sleeping hours	10	9	8	7	6

3. Find the value of the correlation coefficient from the following table:

Subject	Age X	Glucose Level Y
1	43	99
2	21	65
3	25	79
4	42	75
5	57	87
6	59	81

4. The values of the same 15 students in two subjects A and B are given below; the two numbers within the brackets denoting the ranks of the same student in A and B respectively.

(1,10) (2,7) (3,2) (4,6) (5,4) (6,8) (7,3) (8,1).

(9,11) (10,15) (11,9) (12,5) (13,14) (14,12) (15,13)

Use Spearman's formula to find the rank Correlation Coefficient.

5. Calculate Karl Pearson's coefficient of correlation from the advertisement cost and sales as per the data given below:

Advertisement Cost (in'000 $)	39	65	62	90	82	75	25	98	36	78
Sales (in lakh $)	47	53	58	86	62	68	60	91	51	84

6. The following observations are given for two variables.

Y	X
5	2
8	12
18	3
20	6
22	11
30	19
10	18
7	9

(a) Compute and interpret the sample covariance for the above data.

(b) Compute and interpret the sample correlation coefficient.

7. A trainee manager wondered whether the length of time his trainees revised for an examination had any effect on the marks they scored in the examination. Before the exam, he asked a random sample of them to honestly estimate how long, to the nearest hour, they had spent revising. After the examination he investigated the relationship between the two variables.

Trainee	A	B	C	D	E	F	G	H	I	J
Revision time	4	9	10	14	4	7	12	22	1	17
Exam mark	31	58	65	73	37	44	60	91	21	84

(a) Plot the scatter diagram in order to inspect the data.

(b) Calculate the correlation coefficient.

8. Positive values of covariance indicate

(a) a positive variance of the x values

(b) a positive variance of the y values

(c) the standard deviation is positive

(d) positive relation between two variables

9. A numerical measure of linear association between two variables is the

(a) variance

(b) coefficient of variation

(c) correlation coefficient

(d) standard deviation

10. The coefficient of correlation ranges between
    (a) 0 and 1
    (b) -1 and +1
    (c) minus infinity and plus infinity
    (d) 1 and 100
11. The coefficient of correlation:
    (a) can be larger than 1
    (b) cannot be larger than 1
    (c) cannot be negative
12. If height is independent of average yearly income, what is the predicted correlation between these two variables?
    (a) 1
    (b) –1
    (c) 0
    (d) Impossible to say for sure
13. A student produces a correlation of +1.3. This is
    (a) a high positive correlation
    (b) a significant correlation
    (c) an impossible correlation
    (d) only possible if N is large
14. What sort of correlation would be expected between a company's expenditure on health and safety and the number of work related accidents..
    (a) positive
    (b) negative
    (c) none
15. If A scored the top mark in the apprentices test on computing and the correlation between that test and the test on English language was +1.0 what position did A get in the test on English language.
    (a) middle
    (b) bottom
    (c) top
    (d) cannot say from the information given

Notes

16. Which correlation is the strongest +0.65 or -0.70

    (a) –0.70

    (b) +0.65

    (c) depends on N

    (d) cannot say from the information given

17. The symbol for the Karl Pearson Correlation Co-efficient is –

    (a) Σ

    (b) σ

    (c) α

    (d) r

18. When "r" is negative, one variable increases in value, …..

    (a) the other increases

    (b) the other increases at a greater rate

    (c) the other variable decreases in value

    (d) there is no change in the other variable

    (e) all of the above

19. If two variables are absolutely independent of each other the correlation between them must be,

    (a) –1

    (b) 0

    (c) +1

    (d) +0.1

20. For a normal good, if price increases then the quantity demanded decreases. What type of correlation co-efficient would you expect in this situation?

    (a) 0

    (b) positive

    (c) 0.9

    (d) negative

    (e) unknowable

ANSWERS TO INTEXT QUESTIONS

10.1

1. A positive correlation does exst; however correlation does not imply causation
2. Positive, since in general, people grow in height increasing with age

10.2

1. (b)
2. (c)

10.3

1. (b) 2. (b) 3. (b) 4. (c) 5. (c)
6. (c) 7. (a) 8. (d) 9. (d)

10.4

1. (a) $r = 0$
2. (b) $r = 1$ or $r = -1$ these two are same as $|r| = -1$

10.5

1. (d)

10.6

1. +0.67 this indicates a strong positive relationship between the ranks given by two judges i.e. the judges have high degree of common approach towards judgement of beauty.

Notes

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11

INDEX NUMBERS

Of the important statistical devices and techniques, Index Numbers have today become one of the most widely used for judging the pulse of economy, although in the beginning they were originally constructed to gauge the effect of changes in prices. Today we use index numbers for cost of living, industrial production, agricultural production, imports and exports, etc. Index numbers are the indicators which measure percentage changes in a variable (or a group of variables) over a specified time.

OBJECTIVES

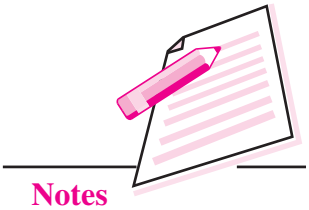
After completing this lesson, you will be able to:

- describe the term index and appreciate its uses;
- differentiate between a weighted and unweighted index;
- construct and interpret a Laspeyer's price index;
- construct and interpret a Paasche's price index;
- construct and interpret a value index;
- explain how the Consumer Price Index is constructed and interpreted;
- explain how industrial production index is constructed; and
- understand its limitations.

11.1 MEANING OF INDEX NUMBER

"An index number is a statistical measure, designed to measure changes in a variable, or a group of related variables".

"Index number is a single ratio (or a percentage) which measures the combined change of several variables between two different times, places or situations".



INDEX NUMBER expresses the relative change in price, quantity, or value compared to a base period. An index number is used to measure changes in prices paid for raw materials; numbers of employees and customers, annual income and profits, etc.

If the index number is used to measure the relative change in just one variable, such as hourly wages in manufacturing, it is referred to as a simple index. An index number can also be used to measure changes in the value of the group of variables such as prices of specified list of commodities, volume of production in different sectors of an industry, production of various agricultural crops, cost of living etc, it is referred to as composite index. Index number measures average change in a group of related variables over two different situations such as prices of specified list of commodities, volume of production in different sectors of an industry, production of various agricultural crops, cost of living etc. Index number does not indicate that the change is uniform for all commodities or group of related variables used to calculate it. It may be noted that in case of, say, Price Index, price of of some of the items may be rising, while it is falling in other items. Price index will only indicate the average change in the price of group of related commodities.

Conventionally, index numbers are expressed in terms of percentage. Of the two periods, the period with which the comparison is to be made, is known as the base period. The value in the base period is given the index number 100. Suppose the change in price in the year 2013 is measured in comparison to the year 2000, then 2000 become the base year and 2013 becomes the current year. For Example By saying that the price index for the year 2013 is 125, taking base year as 2000, it means that there is an increase of 25% in the general price as compared to the corresponding figure for the year 2000. Price index numbers measure and permit comparison of the prices of certain goods. Quantity index numbers measure the changes in the physical volume of production, construction or employment.

11.2 CHARACTERISTICS OF INDEX NUMBERS

Following are some of the important characteristics of index numbers:

- Index numbers are a special type of average that provides a measurement of relative changes in the level of a certain phenomenon from time to time. It is a special type of average because it can be used to compare two or more series which are composed of different types of items or even expressed in different types of units.
- Index numbers are expressed in terms of percentages to show the extent of relative change.
- Index numbers measure relative changes. They measure the relative change in the value of a variable or a group of related variables over a period of time or between places.

Notes

- Index numbers can also measure changes which are not directly measurable. For Example the cost of living, the price level or the business activity in a country are not directly measurable but it is possible to study relative changes in these activities by measuring the changes in the values of variables/factors which affect these activities.

11.3 USES OF INDEX NUMBERS

Index numbers are indispensable tools of economics and business analysis. Following are the main uses of index numbers.

(i) Index numbers are economic barometers. Index numbers measure the level of business and economic activities and are therefore helpful in gauging the economic status of the country. Index number is a special type of averages which helps to measure the economic fluctuations on price level, money market, economic cycle like inflation, deflation etc.

(ii) Index numbers helps in formulating suitable economic policies and planning etc. Many of the economic and business policies are guided by index numbers. For example, while deciding the increase of DA of the employees; the employers have to depend primarily on the cost of living index. If salaries or wages are not increased according to the cost of living it leads to strikes, lock outs etc. The index numbers provide some guide lines that one can use in making decisions.

(iii) Index numbers are used in studying trends and tendencies. Since index numbers are most widely used for measuring changes over a period of time, the time series so formed enable us to study the general trend of the phenomenon under study.

(iv) Index numbers are useful in forecasting future economic activity. Index numbers are used not only in studying the past and present workings of our economy but also important in forecasting future economic activity.

(v) Index numbers measure the purchasing power of money. The cost of living index numbers determine whether the real wages are rising or falling or remain constant. The real wages can be obtained by dividing the money wages by the corresponding price index and multiplied by 100. Real wages helps us in determining the purchasing power of money.

11.4 CONSTRUCTION OF AN INDEX NUMBER:

The various methods of construction of Index numbers are explained through price index numbers. The methods of construction of price index numbers can be classified into broad categories as shown below:

Table 11.1: Price Indices

Un-weighted Index		Weighted Index	
Simple Aggregative Method	Simple Average of Price Relatives Method	Weighted Aggregative Method	Weighted Average of Price Relatives Method

11.4.1 Un-weighted Index

In the un-weighted index number the weights are not assigned to the various items used for the calculation of index number. Two unweighted price index number are given below:

(i) Simple Aggregate Method

This method is based on the assumption that various items and their prices are quoted in same units. Equal importance is given to all the items. The formula for a simple aggregative price index is given as follows:

$$P_{01} = \frac{\Sigma P_1}{\Sigma P_0} \times 100$$

where ΣP_1 is the total of current year's prices for the various items.

ΣP_0 is the total of base year's prices for the various items.

Example 1: From the following data compute price index number for the year 2014 taking 2013 as the base year using simple aggregative method:

Commodity	Prices in the year 2013	Prices in the year 2014
A	1	5
B	2	4
C	3	3
D	4	2

Solution:

Table 11.2: Computation of price Indian number using Aggregative Method

Commodity	Prices in the year 2013 P_0	Prices in the year 2014 P_1
A	1	5
B	2	4
C	3	3
D	4	2
	$\Sigma P_0 = 10$	$\Sigma P_1 = 14$

The price index number is given by:

$$P_{01} = \frac{\Sigma P_1}{\Sigma P_0} \times 100 = \frac{14}{10} \times 100 = 140$$

From this price index of 140, it can be concluded that the aggregate of the prices of the given group of commodities has increased by 40% over the period from 2013 to 2014.

This price index number calculated by using simple aggregative method has limited use. The reasons are as follows:

(a) This method doesn't take into account the relative importance of various commodities used in the calculation of index number since equal importance is given to all the items.

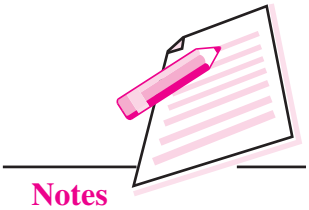
(b) The different items are required to be expressed in the same unit. In practice, however, the different items may be expressed in different units.

(c) The index number obtained by this method is not reliable as it is affected by the unit in which prices of several commodities are quoted.

(ii) Simple Average of Price Relatives Method

This method is an improvement over the previous method as it is not affected by the unit in which the prices of various commodities are quoted. The price relatives are pure number and therefore are independent of original units in which these are quoted. The price index number using price relatives is defined as follows:

$$P_{01} = \frac{\Sigma \frac{P_1}{P_0} \times 100}{N}$$



where P_1 and P_0 indicate the price of the ith commodity in the current period and base period respectively. The ratio $(P_1/P_0) \times 100$ is also referred to as price relative of the commodity and n stands for the number of commodities.

Using the data of Example 1 the index number using price relative method can be calculated as follows:

Table 11.3: Calculation of Index number using Simple Price Relative Method

Commodity	Prices in the year 2013 P_0	Prices in the year 2014 P_1	Price Relatives $\frac{P_1}{P_0} \times 100$
A	1	5	500
B	2	4	200
C	3	3	100
D	4	2	50
	$\Sigma P_0 = 10$	$\Sigma P_1 = 14$	$\Sigma \frac{P_1}{P_0} \times 100 = 850$

$$P_{01} = \frac{\Sigma \frac{P_1}{P_0} \times 100}{N} = \frac{850}{4} = 212.5$$

Thus the price in the year 2014 are112.5% higher in 2013.

The index number based on simple average of price relatives is not influenced by the units in which the prices of the commodities are quoted.

However, this method like simple aggregative method gives equal importance to all the items and thus neglects their relative importance in the group.

11.4.2 Weighted Index Number

In weighted index number rational weights are assigned to all the items or commodities. Such weights indicate the relative importance of the items included in the calculation of the index. In most cases quantity of usage is the best measure of importance.

(i) Weighted Aggregative Price Indices

In weighted aggregative price indices, the weights are assigned to each item in the basket in various ways and the weighted aggregates are also used in different ways

to calculate an index. In most cases quantity of usage is used to calculate price index number. Laspeyre's price index and Paasche's price index are the two most important methods of calculating weighted price indices. Laspeyre's price index number is the weighted aggregative price index number which uses base year's quantity as the weights. It is given by:

$$P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100$$

In general, Laspeyre's index number answers the question, it provides an explanation to the question that if the expenditure on base period basket of commodities was ₹100, how much should be the expenditure in the current period on the same basket of commodities?

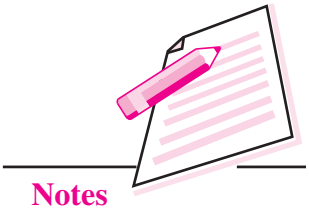
Example 2: From the following data compute Laspeyre's index number for the current year:

Items	Base Year		Current Year	
	Prices (in ₹)	Quantity (in kg.)	Prices (in ₹)	Quantity (in kg.)
A	1	6	5	8
B	2	7	4	7
C	3	8	3	6
D	4	9	2	5

Solution:

Table 11.4: Computation of Laspeyre's Index Number

Items	Base Year		Current Year			
	Price (P_0)	Quantity (q_0)	Price (P_1)	Quantity (q_1)	P_1q_0	P_0q_0
A	1	6	5	8	30	6
B	2	7	4	7	28	14
C	3	8	3	6	24	24
D	4	9	2	5	18	36
					$\Sigma P_1q_0 = 100$	$\Sigma P_0q_0 = 80$



Laspeyre's Price index number is given by:

$$P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100 = \frac{100}{80} \times 100 = 125$$

As can be seen here that the value of base period quantities has risen by 25 per cent due to price rise. It means that the price is said to have risen by 25 percent.

Paasche's price index number is the weighted aggregative price index number which uses current year's quantity as the weights. It is given by:

$$P_{01} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100$$

In general, Paasche's index number answers the question, if the current period basket of commodities was consumed in the base period and if we were spending ₹100 on it, how much should be the expenditure in the current period on the same basket of commodities.

In the above example 2 Paasche's price index number can be calculated as follows:

Table 11.5: Computation of Paasche's Price Index Number

Items	Base Year		Current Year			
	Price (P_0)	Quantity (q_0)	Price (P_1)	Quantity (q_1)	P_1q_1	P_0q_1
A	1	6	5	8	40	8
B	2	7	4	7	28	14
C	3	8	3	6	18	18
D	4	9	2	5	10	20
					$\Sigma P_1q_1 = 96$	$\Sigma P_0q_1 = 60$

paasche's price index number is given by:

$$P_{01} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100 = \frac{96}{60} \times 100 = 160$$

Paasche's price index of 160 means the price rise of 60 percent using current year quantities as weights.

INTEXT QUESTION 11.1

1. The paasche index number is based on:
   (a) Base Year Quantity
   (b) Current Year Quantity
   (c) Average of Base and Current Year Quantity
   (c) none of the above
2. What is an index number?
3. Write one use of index numbers.
4. State any two characteristics of index numbers.

(ii) Weighted Price Relative Method

Under this method price index is constructed on the basis of price relatives and not on the basis of absolute prices. The price index is obtained by taking the average of all weighted price relatives. It is given by

$$P_{01}(\text{weighted arithemetic mean}) = \frac{\sum W\left(\frac{p_1}{p_0}\times 100\right)}{\sum W}$$

Where W = weights

In a weighted price relative index, weights may be determined by the proportion or percentage of expenditure on them in total expenditure during the base or current period. In general, the base period weight is preferred to the current period weight. It is because calculating the weight every year is inconvenient.

Example 3: From the following data compute an index number by using weighted average of price relative method:

Items	Base Year		Current
	Price (P_0)	Quantity (q_0)	Year Price (P_1)
A	1	6	5
B	2	7	4
C	3	8	3
D	4	9	2

Solution:

Calculation of price index number by weighted average of price relatives method using arithmetic mean:

Table 11.6: Calculation of price Index Number

Items	Base Year		Current Year		$W = P_0q_0$	$W\left(\frac{p_1}{p_0}\times 100\right)$
	Price (P_0)	Quantity (q_0)	Price (P_1)	Relatives $= \frac{P_1}{P_0}\times 100$		
A	1	6	5	500	6	3000
B	2	7	4	200	14	2800
C	3	8	3	100	24	2400
D	4	9	2	50	36	1800
					$\Sigma W=80$	$\Sigma W\left(\frac{p_1}{p_0}\times 100\right) = 1000$

$$P_{01}(\text{weighted arithemetic mean}) = \frac{\Sigma W\left(\frac{p_1}{p_0}\times 100\right)}{\Sigma W} = \frac{10000}{80} = 125$$

The weighted price index is 125. The price index has risen by 25 percent.

It may be noted that the values of the unweighted price index and the weighted price index differ.

INTEXT QUESTIONS 11.2

1. From the following data compute an index number by using weighted average of price relative method:

Commodities	Base Year Prices (in ₹)	Current Year Prices (in ₹)	Weights (W)
A	100	90	30
B	20	20	15
C	7	60	20
D	20	15	10
E	40	55	25

11.5 SOME OTHER IMPORTANT INDEX NUMBERS

11.5.1 Consumer price index

A consumer price index (CPI) measures changes in the price level of a basket of consumer goods and services purchased by households. CPI measures changes in the price level for the specified consumers in the particular region. CPI can be calculated for industrial workers, urban labours, Agricultural workers etc. Suppose the CPI for agricultural workers with base year of 2000 is 560 in the April 2012.It means that if the agricultural worker was spending 100 in 2000 for a typical basket of commodities, he needs ₹ 560 in April 2012 to be able to buy an identical basket of commodities. It is not necessary that he/she buys the

basket. CPI only indicates the capability to buy it. It may be noted that there cannot be one CPI for any class or group of the whole country as the retail prices in different places differ. Similarly, we cannot have a cost of living index number for the whole population of a particular town because there exists different group of persons in the town purchasing different baskets of commodities.

CPI is given by :

$$\text{Cost of Living Index} = \frac{\sum WP}{\sum W}$$

where $P=\frac{P_1}{P_0}\times 100$ and W are the weights

Example 4: Construct the consumer price index number for the year 2012 on the basis of 2010 from the following data:

Commodities	Rice	Wheat	Pulses	Butter	Oil
Weights	40	20	15	20	5
Price (per unit in ₹) 2010	16	40	0.50	5.12	2
Price (per unit in ₹) 2012	20	60	0.5	6.25	1.5

Solution:

Table 11.7: Constructing Consumer Price Index Number

Commo-dities	Weights (W)	Price (per unit in ₹) 2010	Price (per unit in ₹) 2012	$P = \frac{P_1}{P_0} \times 100$	WP
Rice	40	16	20	125	5000
Wheat	20	40	60	150	3000
Pulses	15	0.50	0.5	100	1500
Butter	20	5.12	6.25	122	2440
Oil	5	2	1.5	75	375
	ΣW =100				ΣWP =12315

$$\text{Cost of Living Index for 2012} = \frac{\sum WP}{\sum W} = \frac{12315}{100} 123.15$$

INTEXT QUESTIONS 11.3

1. Suppose a person was earning 1500 per month in 2005, what should be his salary in 2010, if the cost of living index number in 2010 with base year 2005 is 170.30?

11.5.2 Wholesale Price Index Number

The Wholesale Price Index or WPI is the price of a representative basket of wholesale goods. The wholesale price index number indicates the change in the general price level. Unlike the CPI, it does not have any reference consumer category. WPI with 2011 as base is 156 in March, 2014 means that the general price level has risen by 56 percent during this period.

11.5.3 Industrial production index

The industrial production index indicates the change in the level of industrial production in the given period comprising many industries. It is a weighted average of quantity relatives. The formula for the index is given by:

$$\text{Industrial Production Index } (IIP_{01}) = \frac{\sum q_1 \times W}{\sum W}$$

Notes

11.6 ISSUES IN THE CONSTRUCTION OF INDEX NUMBERS

There are certain issues that should be kept in mind for the construction of index number which are explained as follows:

Purpose of Index Numbers

An index number, which is designed keeping, specific objective in mind, is a very powerful tool. For example, an index whose purpose is to measure consumer price index, should not include wholesale rates of items and the index number meant for slum-colonies should not consider luxury items like A.C., Cars refrigerators, etc.

Selection of Items

After the objective of construction of index numbers is defined, only those items which are related to and are relevant with the purpose should be included.

Choice of Average

As index numbers are themselves specialized averages, it has to be decided first as to which average should be used for their construction. The arithmetic mean, being easy to use and calculate, is preferred over other averages (median, mode or geometric mean). In this lesson, we will be using only arithmetic mean for construction of index numbers.

Assignment of weights

Proper importance has to be given to the items used for construction of index numbers. It is universally agreed that wheat is the most important cereal as against other cereals, and hence should be given due importance.

Choice of Base year

The index number for a particular future year is compared against a year in the near past, which is called base year. It may be kept in mind that the base year should be a normal year and economically stable year.

11.7 CONCLUSION

An index number is a statistical measure, designed to measure relative changes in a variable(s) with time/geographical location/other criteria. Index Numbers can be calculated for price, quantity, volume etc. The index numbers need to be interpreted carefully as there are several methods of calculating the index number. The items

to be included and the choice of the base period are important for the calculations. The index numbers are indispensable in economic policy making.

WHAT YOU HAVE LEARNT

- An index number is a statistical measure, designed to meaasure changes in a variable or a group of related variables.
- Conventionally, index numbers are expressed in terms percentage.
- Main characteristics of index numbers are :
  - (i) Index numbers are a special type of average that provide a measurement of relative changes in the level of certain phenomenon from time to time
  - (ii) Index numbers are expressed in terms fo percentages to show the extent of relative change
  - (iii) They measure relative changes.
  - (iv) They can also measure changes which are not directly measureable.
- Index numbers are economic barometers. They help in formulating economic policies and planning etc. They are used in studying trends adn tendencies. Index numbers are useful in forecasting future economic activity. They measure the purchasing power of money.
- The formula to obtain index number by simple average of price relatives method is:

$$P_{01} = \frac{\Sigma P_1}{\Sigma P_0} \times 100$$

- The formula to obtain index number by simple average of price relatives method is:

$$P_{01} = \frac{\Sigma \frac{P_1}{P_0} \times 100}{N}$$

- The formula to get Laspeyre's price index is $P_{01} = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$
- Formula to get Paasche's index number is:

$$P_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$$

- Formula to get index number by weighted price relative method is:

$$P_{01} = \frac{\Sigma W\left(\frac{p_1}{p_0} \times 100\right)}{\Sigma W}$$

- Consumer price index (cost of living index = $\frac{\Sigma WP}{\Sigma W}$

TERMINAL EXERCISES

1. Use the following to answer questions a-d:

   A company buys four products with the following characteristics:

	Number of units bought		Price paid per unit (£)	
Items	**Year 1**	**Year 2**	**Year 1**	**Year 2**
A	20	24	10	11
B	55	51	23	25
C	63	84	17	17
D	28	34	19	20

   (a) Find the simple price indexes for the products for year 2 using year 1 as the base year:

   (b) Find the simple aggregate index for year 2 using year 1 as the base year:

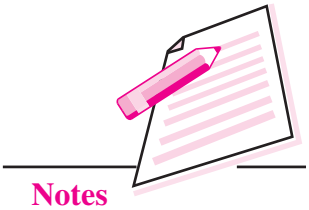
   (c) Find the base-weighted aggregate index, the Laspeyres index, for year 2 using year 1 as the base year.

   (d) Find the current period-weighted aggregate index, the Paasche index, for year 2 using year 1 as the base year.

2. During a certain year, Cost of Living Index Number goes up from 110 to 200 and the salary of worker is also raised from 3250 to 5000. Does the worker really gain?

3. The price relatives and weights of the set of commodities are given in the following table:

Commodities	A	B	C	D
Price Relatives	125	120	127	119
Weights	W1	2 W1	W2	W2+3



If the sum of weights is 40 and the index number for the set is 122, find the numerical value of W1 and W2.

ANSWERS TO INTEXT QUESTIONS

11.1

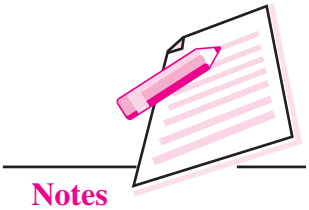
1. (b)
2. Read section 11.2
3. Read section 11.3
4. Read section 11.2

11.2

1. 101.017

11.3

1. ₹ 2554.5



12

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INTRODUCTION TO THE STUDY OF ECONOMICS

Economics is a vast subject encompassing various topics related to production, consumption, saving, investment, inflation, employment and unemployment, national income, international trade, quality of life, fiscal policy, monetary policy etc so on and so forth. The list is unending. From the point of view of better understanding of the subject and finding a solution to the problem, it is imperative to know the nature of the economic issue under study and the area or branch under which the issue is dealt with.

OBJECTIVES

After completing this lesson, you will be able to:

- understand the meaning of economics;
- distinguish between positive and normative economics;
- differentiate between micro and macroeconomics and highlight their components;
- examine the significance of microeconomics and macroeconomics; and
- relate the interdependence of microeconomics and macroeconomics.

12.1 MEANING OF ECONOMICS

The term 'Economics' is derived from two Greek words **OIKOS and NEMEIN,** meaning the rule or law of the household. Economics therefore is concerned with not just how a nation allocates its resources to various uses but it ideals with the process by which the productive capacity of these resources can be further

increased and with the factors which in the past have led to sharp fluctuations in the rate of utilization of resources. British economist Robbins has defined economics as follows:

"Economics is the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses.

Robbins definition is comprehensive in explaining the scope of Economics. It is the problem of 'choice' which is all pervasive in areas of consumption, production and exchange. For example, a consumer has to choose that combination of goods which yields maximum satisfaction. Similarly, a firm has to choose that size of output which ensures maximum profit. **Nobel Laureate Prof. Samuelson has spelled out Economics as follows:**

"Economics is the study of how men and society choose, with or without the use of money, to employ scarce productive resources which could have alternative uses, to produce various commodities over time, and distribute them for consumption now and in the future among various people and groups of society".

12.2 POSITIVE VS NORMATIVE ECONOMICS

While discussing the issues related to the economic conditions and trying to find solutions to economic problems, economists often talk about positive and normative nature of these issues. Positive economics deals with economic analysis which are based on facts and statistical data. When an economic phenomenon is being described with statistical support, then we call it positive economics. So positive economics relates to the phenomenon of 'what is'. On the other hand, normative economics deals with the issue of 'what ought to be'. Normative economics is based on value judgement and debate which are required to arrive at some conclusion. Issues related to framing policies for the society, mostly come under normative economics. Take the example of the issue of India's population. It is the fact that as per 2011 census, India's population was around 121 crore. Since it is based on data, the statement relates to positive economics. But when we discuss about the problems faced due to population pressure, economists and policy makers recommend several solutions such as 'India should control its population by adopting family planning' etc. such a thing comes under normative economics because these can be debate on this policy. There are lot of economic problems faced by the citizens and the economy as a whole. Data are required to justify that a problem exists which is part of positive economics. When we try to find solutions to the problem then value judgements are made and debates take place which comes under normative economics.

INTEXT QUESTIONS 12.1

1. Identify the following statements as positive on normative.
   (i) Government should provide unemployment benefit to the unemployed youths.
   (ii) 27 per cent of India's population belongs to poor sections of the society.
   (iii) India should take loan from world bank to create more infrastructure.
   (iv) RBI should increase the bank rate to curb inflation.
   (v) RBI has increased the bank rate to 6 percent.

12.3 MICROECONOMICS VS MACROECONOMICS

Modem economics is studied in two parts- Microeconomics and Macroeconomics. Micro means small. So, when the study or the problem relates to an individual unit or part of the economy then the subject of study is micro economics. Macro means large. When the study relates to the whole economy or to aggregates relating to the whole economy then the subject of study is macro economics.

Microeconomics

Microeconomics is the study of economic activity of an economic unit or a part of the economy or a small group of more than one unit. Derived from the Greek word *micros* meaning small, it relates to the individual economic agent's behaviour and the result of such interactions in determining the price of goods and services.It is, thus, also called Price Theory.

It is the microscopic study of the economy which deals with decision making by any individual, firm,household with respect to matters of production, consumption, determination of prices in the market,determination of wage rate, and so on. The aim is to provide a framework within which the behaviour patterns and interrelationships between individual economic units can be studied and their behaviour with regards to production, exchange and distribution of goods and services can be predicted. Thus, attainment of a state of equilibrium from the point of view of individual economic units is the main aim in microeconomic analysis.

Further, micro economics also puts emphasis on behaviour patterns and role of firms and individuals in income distribution and study of conditions of efficiency in production and attainment of overall efficiency. Efficiency implies optimum allocation of resources among the consumers and producers so that there is neither excess demand nor excess supply of goods and services. The analysis of the three central problems of an economy- what goods and services to be produced, how to produce them and how they can be distributed in the economy are all subject matter of micro economics.

INTEXT QUESTIONS 12.2

Which one of the following statements is correct?

(a) Determination of price of agood

(b) What goods to be produced

(c) Bothe (a) and (b)

(d) Only (a)

Macroeconomics

Macroeconomics is the branch of economics that deals with the economic aggregates of a country as a whole. The word macro is derived from the Greek word *macros* meaning large. It has emerged after the British economist John Maynard Keynes published his famous book *The General Theory of Employment, Interest and Money* in 1936. The Great Depression of 1929 made economists think about the subject in a newer way which was holistic and macroeconomic study developed. It is also called the Theory of Income and Employment.

The content of macroeconomic analysis involves a combination of units to get a complete picture of the economic system so as to deal with economic affairs at a large scale. The focus areas are aggregate economic variables of an economy. The components of output, price level and employment operate in an economy simultaneously which indicates that they bear a close relationship with each other. This forms the basis of macroeconomic study which attempts to analyse these attributes together. It sees the economy as a combination of four components- households, firms, government and external sector.

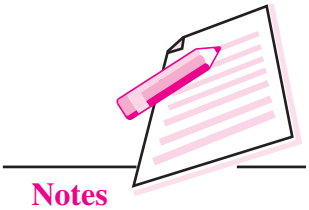
The study area involves the analysis of effects in the market of taxation, budgetary policies, policies on money supply, role of state, rate of interest, wages, employment, and output. It is, therefore, also called *income theory* as it is concerned with the economy as a whole and seeks to study the causes and solutions for economic issues such as unemployment, inflation, balance of payment deficits and so on.

INTEXT QUESTIONS 12.3

1. Give the name of the book authored by Keynes?
2. Which of the following is the subject matter of macro economics?

   (a) Wage rate (b) monopoly

   (c) inflation (d) market price.



12.4 INTERDEPENDENCE OF MICRO AND MACROECONOMICS

Micro economics and macro economics are two parts of economics but they are not mutually exclusive. In other words, they are interrelated. A close interlink exists between macro and micro economics. All micro economic studies can help in better understanding and analysis of the macro economic variables. Such studies also help in the formulation of economic policies and programmes. As you know that the changes and processes in an economy are a result of a variety of large and small scale elements which have a capacity to affect each other and are also affected by each other. For example, increased taxes are a macroeconomic decision but their impact on savings of a firm is microeconomic analysis. Further, how this saving impacts the economy is a macroeconomic analysis.

Take another example. If we know how the price of a commodity is determined and understand the role of buyers and sellers in the process of price determination, it would help us in analysing the changes that take place in the general price level for all the commodities as a whole in the economy. A study of the process of price determination and the role of buyers and sellers in this process is a micro economic study, whereas the study of the general price level in the economy is a macro economic study. Similarly, if we want to assess the performance of an economy, we will have to find out the performance of each sector of the economy and to find out the performance of each sector we will have to find out the performance of each production unit individually or in groups. A study of each group of production unit or of each sector is a micro economic study whereas the study of all the production units or all the sectors taken together is a macro economic study. Thus, micro economics and macro economics are two interrelated parts of economics.

Therefore, the study of both is indispensable in economic study.

12.5 DIFFERENCES BETWEEN MICRO AND MACRO ECONOMICS

Significant differences exist between the two branches in the following ways:

(i) Differences in the scale of study

Macroeconomics is related to the study of the aggregate while microeconomics relates to the individual economic agents

(ii) Differences in the field of study

Macroeconomic analysis is concerned with the broadest level of policies pertaining to income, employment and growth of resources while microeconomics is

concerned with problems and policies relating to the optimum allocation of resources and economic activities such a price determination.

(iii) Differences in importance given to price and income concepts

Microeconomic analysis focuses on price determination in the market for goods and serviceswhile macroeconomics focuses on income determination in the economy as a whole.Every good and service has its market where buyers and sellers interact with one another to determine its price and quantity. Since decisions are taken by the individual buyers who demand the goods and the sellers who supply the goods, it forms the part of micro economics. On the other hand, determination of income of the entire economy involves mobilisation of resources by all the sectors of the economy taken together. So it forms the part of macro economics.

(iv) Differences in the methods of study

Microeconomic study is dominated by the method called Partial Equilibrium Analysis which is focussed on significant factors related to an economic activity. Under macroeconomics, the mutual dependence of important economic aggregates is studied and this is called Quasi General Equilibrium Analysis.

(v) Differences in Analytical Factors

Microeconomics deals with the study of the behaviour of economic variables in an equilibrium position while macroeconomic analysis deals with the study of the behaviour of.economic aggregates in a disequilibrium position.

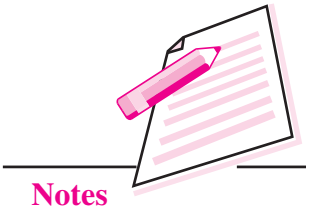
INTEXT QUESTIONS 12.4

State whether the following statements are true or false:

1. Micro economics studies the aggregates of the economy.
2. Macro economics deals with partial equilibrium analysis.
3. Macro economics addresses the issue of unemployment in the economy.
4. Economic policies are studied under micro economics.

12.6 SIGNIFICANCE OF MACRO AND MICRO ECONOMICS

Both the branches of economic analysis are complementary and supplementary to each other. The applied aspects of these relate to the fields of economics and



commerce. The significant areas of microeconomic analysis lie in agricultural economics, labour economics, international economics, consumer economics, comparative economics, welfare economics, regional economics, aspects of public finance and other fields.Macroeconomic studies are applied in the fields of formulation and execution of economic policies, understanding microeconomics, studying economic development, welfare studies, inflation and deflation studies and international comparisons as well.

WHAT YOU HAVE LEANT

- Positive economics relates to the phenomenon of 'what is' which is based on facts.
- Normative economics deals with the issue of 'what ought to be' and is based on value judgement.
- Microeconomics is the study of economic activity of an economic unit or a part of the economy or a small group of more than one unit.
- macroeconomics is a branch of economics that studies the aggregates or economy as a whole.
- All macroeconomic studies can help in better understanding and analysis of the microeconomic variables. Such studies also help in the formulation of economic policies and programmes.
- Significant differences between microeconomics and macroeconomics are:
  - (i) differences in scale of study,
  - (ii) differences in the field of study,
  - (iii) differences in the importance given to price and income concepts,
  - (iv) differences in the methods of study,
  - (v) differences in the assumption,
  - (vi) differences in analytical factors.

TERMINAL EXERCISE

1. Define macroeconomics.
2. Define microeconomics.
3. What is the significance of the study of microeconomics?
4. Explain the difference between microeconomics and macroeconomics.

5. What are the fields of study in microeconomics and macroeconomics.
6. What is the significance of study of macroeconomics?
7. Distinguish between positive and normative economics with examples.

ANSWERS TO INTEXT QUESTIONS

12.1

(i) Normative
(ii) Positive
(iii) Normative
(iv) Normative
(v) Positive

12.2

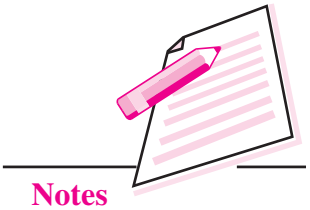
(c) both (a) and (b)

12.3

1. General theory of employment interest and Money
2. (c) Inflation

12.4

1. False
2. False
3. True
4. False



Notes

13

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CENTRAL PROBLEMS OF AN ECONOMY

Economics is about how people make decisions given their limited resources. The decisions are taken with regard to the basic economic activities such as production and consumption of goods and services and saving and investment. However, taking decision is not easy or simple. One must estimate the wants and the availability of resources while taking decisions on production of goods and services. Similarly distribution of the produced goods in the society needs to be done properly. The basic problems central to any economy, therefore, relate to production, consumption and distribution.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the causes of economic problems;
- identify the central problems: 'what to produce', 'how to produce' and 'for whom to produce';
- understand the concept of production possibility frontier curve;
- explain the concepts of opportunity cost and marginal opportunity cost; and
- describe the central problems of an economy by using the production possibility curve.

13.1 WHY DO ECONOMIC PROBLEMS ARISE

The economic problem arises in every economy due to

(a) Unlimited wants

(b) Limited resources

(c) Alternative uses of resources.

(a) Unlimited Wants

Human beings are required to satisfy their basic needs for their survival. For example, a person needs food, water, clothing and shelter in order to survive. These are the basic needs of a person. However, no person would like to satisfy only his/her basic needs if he/she could improve his/her life. People, by nature, want more than what they just need for survival. If one want is satisfied, many others crop up and this goes on endlessly.

Let us understand this through an example. Suppose Neha wants some food, a blouse, utensil for her mother, sweets for her brother, and bangles. These may be only a few of the many things that Neha may like to have if she had some money. This example shows that an individual's wants are unlimited.

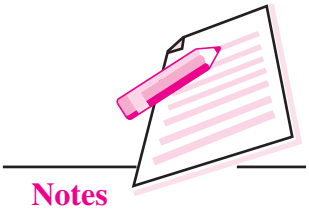
(b) Limited Resources

Let us say that all the things said above are available at some price. Now suppose that Neha has only ₹ 1000 with her to spend. Let food is available at ₹ 150, a blouse costs ₹ 200, value of utensil is ₹ 600, a packet of sweet costs ₹ 200 and a set of bangles is available at ₹ 50. All these taken together would cost Neha ₹ 1200. Since she has only ₹ 1000 with her, Neha has to adjust her purchases accordingly. Here, we say that the means to satisfy Neha's wants are limited to ₹ 1000. People may have high or low income but not unlimited income. Hence, resources (or income) available to consumers are scarce or limited.

Resources also include factors of production: land, labour, capital and entrepreneurship. These resources are not available in abundance in this world. They are scarce or limited. Scarcity means that the demand for the resources is greater than their availability.

(c) Alternative Uses of Resources

The above example also highlights another important fact that a resource can be used in different ways. In Neha's case, she can use her ₹ 1000 to buy some items. Once she chooses to buy something (for example utensil for her mother) then she can not satisfy her other wants. Similarly, all factors of production can be put to alternative uses. For example, a piece of land can be used to do farming, build a factory, develop a school or build a hospital. A labour can be used to plough a field, to make baskets or to sell vegetables. Hence, we see that resources have alternative uses.



From the above discussion we can see that wants are unlimited but resources (to satisfy the wants) are limited which happens to be the basic economic problem faced by all economies. We have also discussed that resources have alternative uses. This basic problem exists in every economy - whether rich or poor; developed or developing.

Scarcity of resources also leads to choice. In our example, Neha has only ₹ 1000 to spend but she wants to buy many things which was limited. So she must choose what she wants. In this way a consumer tries to solve the economic problem of unlimited wants and limited resources. Similarly producers also face the economic problem as they need to decide as to which alternative use should they put their scarce resources.

Suppose resources were not limited. Would it still lead to the economic problem? The answer to this question is that if resources were not scarce they could be used to satisfy all wants. Hence, the basic problem of scarcity and choice would not arise. Scarcity of resources results in people making decisions about how best they would like to use these limited resources. Making the best use of resources is termed as e**conomizing of resources**. Economizing of resources does not mean being miserly about using resources, but using resources judiciously so that maximum benefit can be obtained from the scarce resources.

INTEXT QUESTIONS 13.1

State whether the following statements are true or false:

1. Resources are scarce.
2. Wants are limited.
3. Scarcity does not lead to choice.
4. Resources have alternative uses.
5. Every economy does not face the basic economic problem.
6. Economizing of resources means being miserly about using resources.
7. Land is a factor of production.
8. Human wants are unlimited.
9. Resources are scarce if demand is less than its availability.
10. Only producers face economic problems.

13.2 CENTRAL PROBLEMS OF ECONOMY

As we have discussed above, every economy in the world faces the economic problem of unlimited wants and limited resources. This economic problem gives rise to people making choices about how they would like to use scarce resources. This economic problem gives rise to the central problems of an economy which are as following

- What to produce and in what quantities?
- How to produce?
- For whom to produce?

These are called central problems because every economy has to face them and seek solutions to them.

Collectively, these central problems are called **the Problem of Allocation of Resources.**

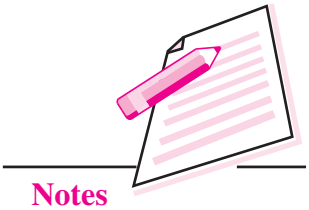
Let us discuss each of these central problems in detail

(a) What to produce and in what quantities?

The fact that resources are scarce leads to the problem of 'what to produce' and in what quantities to produce. An individual producer needs to decide on how to employ the sources that are available to her for production. For example, if Lata, a farmer has a piece of land, she needs to think about what crop she would like to produce on her land. Let us assume taht she can grow either sugarcane or wheat. Given that her land is limited, she needs to choose whether she wants to use the land to produce sugarcane or wheat or both. Once Lata has taken this decision she needs to think about the quantity of the crop that she would like to produce. For example, 10 quintals, 20 quintals or 50 quintals.

This problem of 'what to produce' and in what quantities to produce is faced by all economies. An economy needs to choose whether it wants to use its resources to produce consumer goods or producer goods. Alternatively, to what extent should luxury goods be produced in comparison to necessities or goods of mass consumption? An economy may also be faced with the question of how much of civilian goods to be produced and how much of defence goods to be produced. In other words, scarce resources require economies to decide the combination of goods and services they should produce.

The problem of what to produce and in what quantities to be produced can be solved by a government that decides the allocation of resources in different areas of production. Alternatively, it can be solved based on the preferences of people in an economy and on the price of goods and services in market.



(b) How to produce?

Choosing the technique of production relates to the problem of 'how to produce'. By technique of production we mean the different combination of factors of production that can be used to produce a good.

Generally all goods can be produced through different methods of production. Various methods of production require different combinations of factors of production. A technique of production could be either labour intensive or capital intensive. *In a production process when more units of labour are used in proportion to capital, it is termed as a labour intensive technique. Alternatively, when the proportion of capital used is more than labour, the production process is called a capital intensive technique.*

Let us understand this with the help of some examples. On Lata's farm, she has the choice of using different combinations of labour and capital to produce her crop. If she chooses to do the ploughing, sowing, harvesting and threshing with her bullocks and employing people, then she is using a labour intensive technique. On the other hand, if she uses machines such as tractor, harvester and thresher to do the same work, then she is using a capital intensive technique of production. Similarly, in cloth production the use of handlooms is a labour intensive technique to produce cloth whereas the use of powerlooms is a capital intensive technique of production of cloth.

The solution of the problem of how to produce is based on the extent of output that is produced for a given level of resources. Any producer would like to maximize the level of output from the available resources. At the same time cost of using a technique is equally very important. A producer will use that particular technology which is available at least cost.

(c) For whom to produce?

The problem of 'for whom to produce' relates to how the value of the produced output of an economy gets distributed amongst different people. People do not receive the output they produce as their compensation. The output is sold and the money is earned in the production process. This money is paid as income to people for the work they have done in the production process. This income, in turn, is used by people to satisfy their wants. Hence, the problem of for whom to produce tells us how the different factors of production are compensated for their work.

In our example, once Lata's crop is harvested and sold, she needs to pay the various factors of production for their services. The labour will be paid wages, land will be paid rent, capital (in the form of machinery) will be paid interest. Lastly, Lata will earn profit as an entrepreneur for organising the factors of production and undertaking some risk of running the produciton activity.

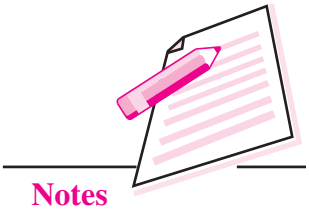
INTEXT QUESTIONS 13.2

Choose the correct answer:

1. The problem of how to produce relates to:
   (a) distribution of income
   (b) technique of production
   (c) choosing the goods to produce
   (d) choosing the quantities to produce
2. The problem of what to produce is solved by:
   (a) preferences of people
   (b) market prices
   (c) government allocation of resources
   (d) all of the above
3. The income earned by labour in the production process will be part of the problem of:
   (a) what to produce and what quantities
   (b) how to produce
   (c) for whom to produce
   (d) none of the above
4. Labour intensive technique of production means:
   (a) the use of only labour in production
   (b) production unit is owned by labour
   (c) the technique used for producing necessities
   (d) the use of more labour than capital in producing goods
5. The central problems facing an economy relates to:
   (a) the allocation of resources
   (b) what to produce
   (c) how to produce
   (d) for whom to produce

13.3 OTHER CENTRAL PROBLEMS OF THE ECONOMY

In addition to the central problems discussed in the previous section, every economy faces two other problems. These are:



(a) The problem of optimum utilization of resources

(b) The problem of growth of resources

Let us discuss each of these problems in detail.

(a) Optimum Utilization of Resources

Resources are scarce they must not be wasted. They must also be used judiciously to give the maximum output. Thus, optimum utilization of resources has the following implications:

(i) All resources must be utilized and

(ii) Resources must be used efficiently

These two issues are discussed below:

(i) *All resources must be utilized*

If resources are not utilized/employed or are lying idle, it means that they are being wasted. Wastage of resources results in low output. For example, people may be unemployed. This means that human resources are being wasted. Similarly, when workers in a factory go on strike, capital resources lie idle and are wasted. If these resources are utilized, the output that can be produced in the economy shall rise. Thus, every economy must ensure that scarce resources are utilized and not left idle or unemployed.

(ii) *Efficient Utilization of resources*

Since resources are scarce, they should not be under utilized. Under utilization of resources means that resources are not being used to their fullest capacity. For example, if a person finds a job in which he works only for 4 hours a day, but his capacity to work is 8 hours a day, then his labour is under utilized. In other words, the person is not being employed efficiently. If he had a job for 8 hours a day, the output would increase. Under utilization of resources also results in wastage of resources. Hence, every economy must try and adopt techniques of production that ensure efficient utilization of resources.

(b) Growth of resources

We have studied earlier in the chapter that wants are unlimited. This means that people continuously want more and more goods. However, these ever increasing wants can not be satisfied unless the resources that produce goods and services are increased. Thus, resources must grow to satisfy the constantly increasing wants in an economy. So, how can resources grow in an economy? Resources can increase if:

(i) *There are quantitative changes in the resources*

Quantitative increase in resources occurs when the actual quantity of resources that is available in the economy increases. For example, when the population increases, then the quantity of human resource increases. Similarly, when more natural resources are found, it increases the availability of resources in an economy.

(ii) *There are qualitative changes in resources*

Qualitative changes in human capital occur due to better training and skill development. Qualitative changes in man made capital occur when there is an improvement in technology. Under qualitative changes, the amount of resources available does not change but their productivity increases. Productivity is defined as the output per unit of input. For example, if labour gets trained, then the output from the same person can increase. Productivity improves due to better skill and training.

To conclude our discussion, growth of resources occurs when the physical availability of resources increases and/or there is technological upgradation or an improvement in the quality of resources.

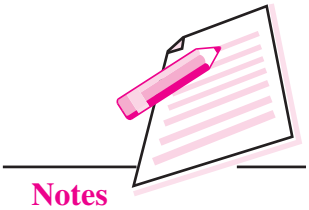
INTEXT QUESTIONS 13.3

Choose the correct answer:

1. Under utilization of resources means that resources are being used ..... (efficiently/inefficiently)
2. Technological ..... (backwardness/improvement) leads to growth of resources.
3. Resources should remain ..... (idle/fully utilised).
4. If a person is ..... (employed/unemployed), it means that the resource is being wasted.
5. Quantitative change in resources means that ..... (there is more laboour available/ labour gets more skill and training).

13.4 CONCEPT OF PRODUCTION POSSIBILITIES

In deciding 'what to produce' and how much, an economy has to take decisions regarding allocation of resources among different possible alternatives. Let us assume that the economy is producing only two commodities, rice and bicycles. With the limitation of the total resources, if all the resources are utilized in the production of rice, let 20 quintals of rice can be produced and no production of



bicycle will take place. If more and more resources are being diverted towards the production of bicycles, little amount will be left for the production of rice. Similarly if all the resources are being used in the production of bicycles, say 150 bicycles can be produced and no resources will be left for the production of rice. Therefore, the scarce resources are employed in various combinations to get alternative production possibilities.

The production possibilities curve is a graphical medium of highlighting the central problem of 'what to produce'. To decide what to produce and in what quantities, it is first necessary to know what is obtainable. The curve shows the options that are obtainable, or simply the production possibilities. What is obtainable is based on the following assumptions:

- The resources available are fixed.
- The technology remains unchanged.
- The resources are fully employed.
- The resources are efficiently employed.

The resources are not equally efficient in production of all products. Thus, if resources are transferred from production of one good to another, the cost of production may increase.

13.5 PRODUCTION POSSIBILITY SCHEDULE

To simplify, let us assume that only two goods are produced in an economy. Let these two goods be guns and butter. The example given by a famous economist Samuelson who won nobel prize in economics in the year 1969. The example, symbolizes the problem of choice between war goods and civilian goods. Given the extremes and the in-between possibilities, a schedule can be prepared. It can be called a production possibilities schedule. A Production Possibilities Schedule (or Table) is a set of numbers in tabular form that illustrates different possible combinations of two goods that can be produced if all available resources are efficiently used during a given time given technology of production. Suppose if all the resources are engaged in the production of guns, there will be a maximum amount of guns that can be produced per year. Let it be 15 units. At the other extreme suppose all the resources are employed in production of butter only. Let the maximum amount of butter that can be produced is 5 units. These are the two extreme possibilities. In between the resources can also be partly used for the production of guns and partly for production of butter. Given the extremes and the in-between possibilities, a schedule can be prepared. It can be called a production possibility schedule (PPS). Let the schedule be given as follows.

Possibilities	Guns (units)	Butter (units)	MRT
A	15	0	–
B	14	1	4
C	12	2	2
D	9	3	3
E	5	4	4
F	0	5	5

13.6 PRODUCTION POSSIBILITIES CURVE/FRONTIER

The central problems of an economy are explained by modern economists with the help of Production Possibility Schedule (PPS) or Production Possibility Curve (PPC). PPS shows alternative production possibilities of two sets of goods with the given resources and techniques of production. PPC is a graphic representation of PPS. It is also called Production Possibility Frontier (PPF). This curve is also called Transformation Curve since it indicates that if more of butter is to be produced, then factors will have to be withdrawn from the production of guns and transferred towards the production of butter.

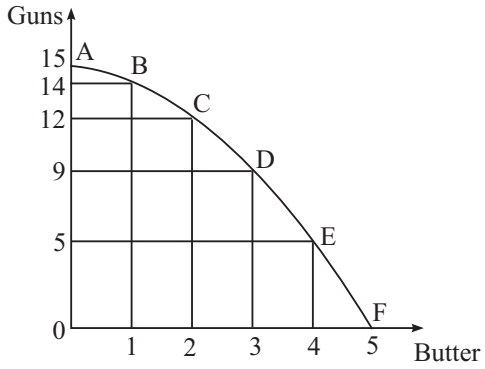
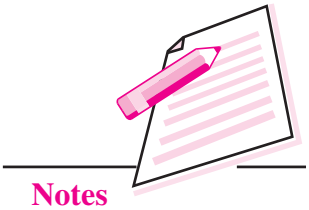


Fig. 13.1

In Fig. 13.1 the curve AF is called PPC. As shown in the diagram, when all the resources are used for production of guns only the economy produces 15 units of guns and no butter. This is marked as point A. When some resources are transferred to increase production of butter from 0 to 1 unit, then production of gun fall from 15 to 14 so that the economy reaches at point B on PPC and so on. Finally all resources are transferred from guns to produce only butter, then the economy reaches at point F, where it produces 5 units of butter and no gun. This way the



locus ABCDEF gives the PPC. So PPC is a graphical representation of the alternative combinations of the amounts of two goods or services that an economy can produce by transferring resources from one good or service to the other. This curve helps in determining what quantity of a nonessential good or a service an economy can afford to produce without jeopardizing the required production of an essential good or service. PPC has two following properties:

(a) PPC slopes downward: This means that more of a good can be produced only by sacrificing some quantity of the other good.

(b) PPC is concave to the point of origin: You can see that some amount of gun has to be reduced to produce one unit extra of butter. This is done by transferring resources from the produciton of gun to that of butter. The rate at which the units of a good is reduced to increase a unit of another good is called marginal rate of transformation (MRT). MRT is measured along PPC when the economy moves from one point to another. In Fig. 13.1, movement from point A to B to C and so on gives the idea of MRT. When the economy moves from point A to B, 1 unit of gun is reduced (from 15 units to 14 units) to produce extra unit of butter (from 0 to 1 unit). When the economy moves from point B to C, 2 units gun are given up (from 14 to 12 units) to produce another unit of butter (from 1 to 2 units). This way some units are guns are reduced to gain one unit of butter. So MRT measures the change in one good (here gun), due to change in another good (here butter).

Hence MRT measures the rate of change of PPC or simply the slope of PPC. On a concave shaped PPC as in Fig. 13.1, we see that when we increase butter by one unit, we have to decrease gun by more units than before. So on a concave PPC, MRT increases.

$$\text{Here MRT} = \frac{\text{Change in Guns}}{\text{One unit change in Butter}}$$

The curve is based on the following assumptions:

(a) quantity of factors of production is fixed

(b) full employment

(c) technology is given

(d) There are two goods produced in the economy.

PPC can be a straight line if production is obtained under law of constant returns or when marginal rate of transformation of both the commodities is same. For e.g. to produce one more unit of commodity X if only one unit of commodity Y is sacrificed through out then PPC becomes a straight line. However, this is only a conceptual possibility. The significance of this curve lies in the interpretation of the central problems and help in finding solutions to them. This is done through

analysing the output with changing combination of resources. Situation of economic growth can also be analysed through the shifts in PPC as observed after growth in capital stock, changes in investment and improvement in technology.

INTEXT QUESTIONS 13.4

State whether the following statements are true or false:

1. A point on the PPC implies that resources are fully utilised.
2. A point inside the PPC implies existence of under employment.
3. A PPC is drawn on the assumption that resources of the economy are increasing.

13.7 UNDERUTILISATION OR INEFFICIENT UTILIZATION OF RESOURCES

We have seen above that any point on the production possibility curve represents full and efficient utilization of resources. If, however, the economy functions at a point inside the production possibility curve, then it shows that there exists either underutilization or inefficient utilization of resources.

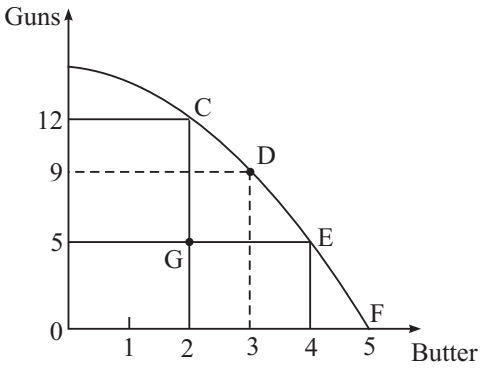
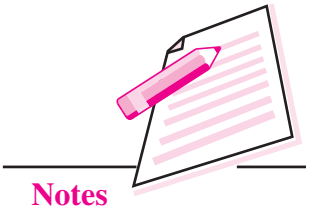


Fig 13.2 : Underutilisation or inefficient utilization of resources

Refer to our schedule of PPL given earlier.

Let us understand this point with the help of a diagram given in Fig. 13.2. In Fig. 13.2, we see that at point G, the economy is producing 2 units of butter and 5 units of guns. Through a re-allocation of resources, the economy can do one of the following:

(a) increase the production of guns to 12 units and keep the production of butter at the same 2 units as at point C on PPC.



(b) increase the production of butter to 4 units and keep the production of guns same at 5 units as shown at point E on PPC.

In both (a) and (b) above, we see that the economy has been able to increase the production of the one of the goods if it moves towards point C or E on PPC from the point G which is inside PPC.

(c) In fact the economy can produce more of both the goods on any point on PPC (e.g. at point D) as compared to point G.

Therefore, we can conclude that at point G the economy was not using its available resources in the best possible manner. So any point inside the PPC shows unemployment of resources.

13.8 GROWTH OF RESOURCES

We have studied earlier that resources in any economy need to grow to satisfy the ever increasing wants of people. Growth of resources occurs when the physical quantum of resources increases or when there is a rise in the productivity level of resources. This implies that with growth in resources, the output produced in an economy will increase. We can use the diagram in Fig. 13.2 to show growth in produciton capacity.

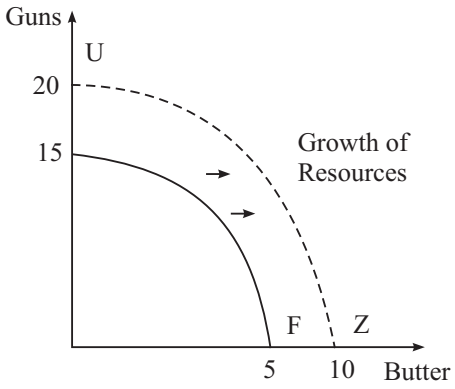


Fig. 13.3 : Production Possibility Curve showing Growth of Resources

In Fig. 13.3, we see that AF is the same production possibility curve as in Fig. 13.1. As resources grow, the economy can now produce more of both guns and butter. This is depicted by the curve UZ. At point U, the economy produces only guns which has increased to 20 units. This is more than the output of gun at point A. Similarly, at point Z, when the production of gun is zero, the output of butter is 20 units. This is greater than the output of 5 units when resources had not grown. All other output combinations show that the output of both guns and butter are higher on the production possibility curve UZ than on the curve AF. This shows that

growth of resources results in an outward shift of the production possibility curve, which results in higher levels of output.

INTEXT QUESTIONS 13.5

1. Choose the correct answer:

   A point on the production possibility curve shows:

   (i) Growth of resources

   (ii) Inefficient utilization of resources

   (iii) Unemployment of resources

   (iv) Full and efficient utilization of resources

2. State whether the following statement, are true or false:

   (a) A point inside the production possibility curve shows underutilization of resources.

   (b) Unemployment of labour means that resources are not being fully employed.

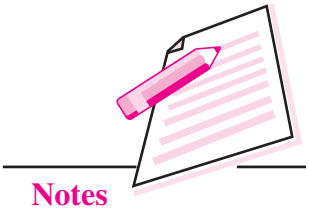
   (c) Better technology will lead to an inward shift of the production possibility curve.

   (d) A production possibility curve can depict more than two goods in an economy.

   (e) An economy needs to choose the point at which it wishes to operate on the production possibility curve, as all points are equally efficient.

WHAT YOU HAVE LEANT

- Scarcity of resources leads to the problem of choice.
- The basic economic problem is faced by both consumers and producers.
- The economic problem gives rise to the central problems in an economy. These are also termed as the problem of allocation of resources.
- The problem of what to produce and in what quantities to produce looks at the different combinations of goods and services that an economy could produce given the available resources which must be used efficiently.
- The problem of how to produce looks at choosing the best technique of production. This could be either labour intensive or capital intensive.
- The problem of 'For whom to produce' looks at how is the output produced in the economy distributed amongst the owners of different factors of production which have helped to produce the output.



- The production possibility curve shows the different combinations of two goods that can be produced with full and efficient utilization of given resources and a given state of technology.
- Any point on the PPC shows resources are being fully and efficiently used.
- Any point inside the PPC shows that resources are being underutilized or are unemployed or are lying idle.
- A growth of resources is reflected by an outward shift of the PPC.

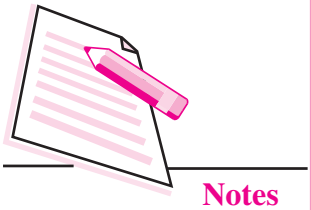
TERMINAL EXERCISE

1. How do economic problems arise? Would there be any economic problem if resources were unlimited?
2. Explain how scarcity leads to choice.
3. Using examples explain the problem of what to produce and in what quantity.
4. Discuss the problem of 'how to produce'?
5. Explain the problem of fuller utilization of resources.
6. How can resources grow in an economy?
7. What is a production possibility curve? Using a production possibility curve show the problem of inefficient utilization of resources.
8. Draw a production possibility curve that shows growth of resources. How does growth of resources affect the output of an economy?
9. Discuss the problems of what and how to produce?
10. Draw a concave PPC by drawing a schedule?
11. Using a PPC explain inefficient utilisation of resources?
12. Using a PPC explain growth of resources?
13. Using a PPC explain efficient utilisation of resources?
14. Give three examples each about microeconomics and macroeconomics?

ANSWERS TO INTEXT QUESTIONS

13.1

1. True	2. False	3. False	4. True	5. False
6. False	7. True	8. True	9. False	10. False



Notes

13.2

1. (b) 2. (d) 3. (c) 4. (d) 5. (a)

13.3

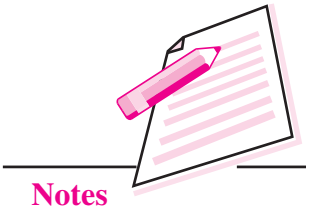
1. inefficiently 2. improvement 3. fully utilized
4. unemployed 5. there is more labour available

13.4

1. True 2. True 3. False

13.5

1. (iv)
2. (a) True (b) True (c) False (d) False (e) True



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CONSUMER'S EQUILIBRIUM

We buy many goods and services to satisfy our wants. Using up of goods and services to satisfy wants is called consumption and the economic agent who buys goods and services is called a consumer. When a consumer buys any good or service, his/her main objective is to get maximum satisfaction from the quantity of the commodities purchased by spending his/her income at the given market price. How does a consumer maximize his/her satisfaction from spending his/her income on various goods and services is the subject matter of this chapter.

OBJECTIVES

After completing this lesson, you will be able to:

- understand the meaning of consumer's equilibrium;
- understand the meaning of utility, marginal utility and total utility;
- understand the relationship between total utility and marginal utility;
- explain the law of diminishing marginal utility;
- explain consumer's equilibrium, based on utility analysis;
- understand the meaning of indifference curve, indifference map, budget line, budget set and marginal rate of substitution; and
- derive consumer's equilibrium using indifference curve and budget line.

14.1 MEANING OF CONSUMER'S EQUILIBRIUM

Equilibrium means a state of rest from where there is no tendency to change. A consumer is said to be in equilibrium when he/she does not intend to change his/her level of consumption i.e., when he/she derives maximum satisfaction. Thus, **consumer's equilibrium refers to a situation where the consumer has achieved**

maximum possible satisfaction from the quantity of the commodities purchased given his/her income and prices of the commodities in the market. As the resources are scarce in relation to unlimited wants, a consumer has to follow some principles or laws in order to attain the highest level of satisfaction.

There are two main approaches to study consumer's equilibrium. They are as follows:

1. Cardinal utility approach (or Marshall's utility analysis)
2. Ordinal utility approach (or indifference curve analysis)

14.2 CARDINAL UTILITY APPROACH

The theory of consumers behaviour by using utility approach was first given by the noted economist Alfred Marshall.

Before discussing how a consumer attains equilibrium , we need to understand the concept of utility, marginal utility and total utility.

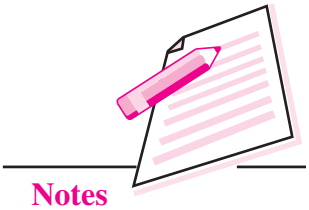
(i) Utility

Utility is defined as the power of a commodity to satisfy a human want. Utility of a commodity is the total amount of psychological satisfaction that a person gets from consumption of a good or service, e.g. a thirsty person derives satisfaction from drinking a glass of water. So a glass of water has got utility for the thirsty person. Utility differs from person to person. Utility is subjective and cannot be measured quantitatively. Yet for the sake of convenience it is measured in 'utils'. Marshall suggested that the measurement of utility should also be done in monetary terms by converting 'util' into money by using the following formula Utility in Money = Utility in Util/Utility of a rupee. Utility of rupee can be assumed to be any number such as 1, 2, 3 ... . Let utility of a rupee is assumed to be 2 utils.

Then 10 utils = $\frac{10}{2}$ = ₹ 5.

(ii) Marginal Utility (MU)

Marginal utility is the addition to the total utility derived from the consumption of an additional unit of a commodity. It can also be defined as the utility from the last unit of a commodity consumed. Let us explain the concept of marginal utility with the help of an example. Suppose, a consumer gets total utility of 10 utils from consumption of one orange and 18 utils from two oranges. He gets 8 utils from consumption of second orange. So, marginal utility of second orange is 8 utils. If total utility derived from three oranges is 24 utils then marginal utility of



three oranges is 6 utils (i.e. 24-18 utils). In this case third orange is the last orange. Thus marginal utility of 3 oranges is 6 utils. Marginal utility can be calculated by the following formula:

$$MU_n = TU_n - TU_{n-1}$$

or

$$MU = \frac{\Delta TU}{\Delta X}$$

Where MU_n = Marginal utility of nth unit of the commodity

TU_n = Total utility of n units

TU_{n-1} = Total utility of n–1 units

X_n = Quantity of nth unit of good X

X_{n-1} = Quantity or (n–1)th unit of good X

"n" takes the values 1, 2, 3, ...

(iii) Total utility

Total utility is the total satisfaction obtained from the consumption of all possible units of a commodity. For example, if the first orange gives you a satisfaction of 10 utils, second one gives you 8 utils and third one gives you 6 utils, then total utility from three oranges = 10 + 8 + 6 = 24 utils. Total utility can be obtained by summing up marginal utilities from consumption of different units of a commodity. Thus, total utility can be calculated as:

$$TU_n = MU_1 + MU_Z + MU_3 + ... MU_n$$

or $$TU_n = \Sigma MU$$

where, TU_n = Total utility from n units of a given commodity

MU_1, MU_2, MU_3, MU_n = Marginal utilities from 1st, 2nd 3rd and nth unit of the commodity

14.3 RELATIONSHIP BETWEEN TOTAL UTILITY AND MARGINAL UTILITY

The relationship between total utility and marginal utility is explained with the help of following table 14.1 and Fig. 14.1.

Table 14.1

Units of Oranges Consumed	Marginal Utility (Utils)	Total Utility (Utils)	
0	–	0	
1	10	10	TU increases at diminishing
2	8	18	rate (MU is
3	6	24	positive)
4	2	26	
5	0	26	TU is maximum when MU is zero
6	–2	24	TU falls when MU is negative

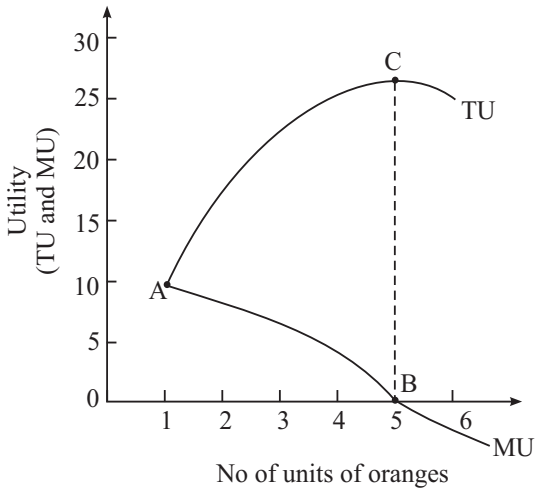
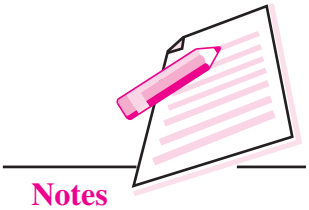


Fig. 14.1

1. MU is the rate of change of TU. It means that Total Utility increases as long as marginal utility is positive. In the table 14.1 marginal utility is declining between the range AB but is positive. So total utility is increasing at decreasing rate.
2. Total Utility is maximum when marginal utility is zero. At point B, MU = 0, and the corresponding point on TU is C where TU is maximum.
3. Total utility starts declining when marginal utility becomes negative (i.e., less than zero)



14.4 LAW OF DIMINISHING MARGINAL UTILITY

It is a matter of common observation that as we get more and more units of a commodity, the intensity of our desire for that commodity tends to diminish. The law of diminishing marginal utility also explains the same thing. It states that **'as more and more units of a commodity are consumed, marginal utility derived from each successive unit goes on diminishing.'**

The law can be explained with the help of an example. Suppose, a thirsty man drinks water. The first glass of water he drinks will give him maximum satisfaction (utility), say, 20 utils. Second glass of water will also fetch him utility but not as much as the first one because a part of his thirst is satisfied by drinking the first glass of water. Suppose he gets 10 utils from the second glass. It is just possible that he may get zero utility from the third glass because his thirst has now been satisfied. There will be negative utility from the fourth glass of water. Any rational consumer will not consume additional glass of water when it gives disutility or negative utility.

14.4.1 Assumption of Law of Diminishing Marginal Utility

The law of diminishing marginal utility operates under certain specific conditions. These are called assumptions of the law. Some important assumptions of the law are:.

1. It is assumed that utility can be measured and a consumer can express his satisfaction in quantitative terms like 1, 2, 3 etc. We have already said that unit of measurement of utility is 'util'. So utility is cardinal.
2. Quality of the commodity should not undergo any change. Take the above example of glass of water. From the quality point of view a consumer who drinks a glass of cold water must continue with the same. He or she cannot change its quality from cold to normal as normal water give different satisfaction.
3. Consumption should not proceed at intervals. It should be a continuous process. Continuing with the above example, second glass of water, if consumed two hours after the first glass of water was consumed, may give more, less or equal satisfaction.
4. Consumer should be a rational person. This means that he/she prefers more quantity to less quantity of a good.
5. Time period of consumption should not be too long. Consumer's tastes, habits, income etc. may change if the time gap is more.
6. The price of the substitute and complementary goods should not change. If these prices change, it may be difficult to predict about the utility derived from the commodity in question.

14.4.2 Exceptions to the Law of Diminishing Marginal Utility

Some of the important exceptions to the law are following:

(i) A miser is not a good subject for this law. His desire for more wealth may in fact increase with every successive increase in the accumulation of wealth.

(ii) A collector of rare articles like stamps, coins, paintings etc. may escape this law.

(iii) The law may not apply when it comes to a melody recital or a beautiful scenic view.

These are in fact the only real exceptions of the law and these too do not prove real hurdles to the application of the law. It is easy to visualize that a miser or stamp collector or a musician may find their marginal utilities increasing instead of decreasing as postulated by the law. But this tendency shall not last for long having reached a particular stage; the law must come into operation.

INTEXT QUESTIONS 14.1

1. What is meant by consumer's equilibrium?
2. Define the following:
   (i) Utility (ii) Marginal Utility (iii) Total Utility
3. State the law of diminishing marginal utility.
4. What will be the total utility when marginal utility is zero?

14.5 CONSUMER'S EQUILIBRIUM IN CASE OF A SINGLE COMMODITY

Consumer's equilibrium in case of a single commodity can be explained on the basis of the law of diminishing marginal utility. How does a consumer decide as to how much to buy of a good? It will depend upon two factors.

(a) The price she pays for each unit which is given and

(b) The utility she gets

At the time of purchasing a unit of a commodity, a consumer compares the price of the given commodity with its utility. The consumer will be at equilibrium when marginal utility (in terms of money) equals the price paid for the commodity say 'X' i.e. $MUx = P_X$. (Note that marginal utility in terms of money is obtained by dividing marginal utility in utils by marginal utility of one rupee).

If $MU_X > P_x$, the consumer goes on buying the commodity because she is paying less for each additional amount of satisfaction. As she buys more, MU falls due to operation of law of diminishing marginal utility. When MU becomes equal to price, consumer gets maximum satisfaction and now she is at equilibrium. When MU_X

$< P_x$, the consumer will have to reduce consumption of the commodity to raise his total satisfaction till MU becomes equal to price. This is because she is paying more than the additional amount of satisfaction that she is getting.

Consumer's equilibrium (in case of single commodity) can be explained with the help of table 14.2. Suppose, the consumer wants to buy a good which is priced at ₹.10 per unit. Further, suppose, MU obtained from each successive unit is determined. Assumed that 1 util = Re. 1.

Table 14.2: Consumer's Equilibrium (in case of a single commodity)

Consumption (Units of X)	Price (₹) (P_X)	MU_X (Utils)	MU_X(₹) (1 Util = Re. 1)	Difference	Remarks
1	10	20	20/1 = 20	10	$MU_x > P_x$, consumer will
2	10	16	16/1 = 16	6	increase the consumption
3	10	10	10/1 = 10	0	$MU_x = P_x$, consumer's equilibrium
4	10	4	4/1 = 4	–6	$MU_x < P_x$, consumer will
5	10	0	0/1 = 0	–10	decrease the consumption
6	10	–2	–2/1 = –2	–12	

It is clear from the table 14.2 that the consumer will be at equilibrium when he buys 3 units of the commodity X. He will increase consumption beyond 2 units as MUx $> P_x$. He will not consume 4 units or more of the commodity X as $MU_x < P_x$.

14.6 CONSUMER'S EQUILIBRIUM IN CASE OF TWO OR MORE COMMODITIES

The law of diminishing marginal utility applies in case of one commodity only. But in real life a consumer normally consumes more than one commodity. In such a situation, law of equi-marginal utility helps in optimum allocation of his income. Law of equi-marginal utility is based on law of diminishing marginal utility. According to the law of equi-marginal utility a consumer will be in equilibrium when the ratio of marginal utility of a commodity to its price equals the ratio of marginal utility of other commodity to its price.

Let a consumer buys two goods X and Y. Then at equilibrium

$MU_x/P_x = MU_Y/P_Y = MU$ of last rupee spent on each good, or simply MU of Money.

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} = \frac{MU_Z}{P_Z} = MU_{Money} - MU_{Money}$$

Similarly if there are three goods X, Y, Z then the condition of equilibrium will be simply MU Money.

Thus, to be in equilibrium

1. Marginal utility of the last rupee of expenditure on each good is the same.
2. Marginal utility of a good falls as more of it is consumed.

To explain the consumer's equilibrium in case of two goods let us take an example. Suppose a consumer has ₹ 24 with him to spend on two goods X and Y. Further, suppose price of each unit of X is ₹ 2 and that of Y is ₹ 3 and his marginal utility schedule is given in table 14.3.

Table 14.3: Consumer's Equilibrium (in case of two goods)

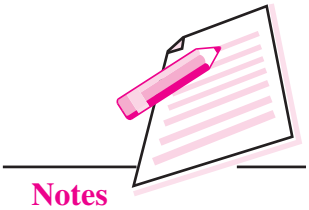
Units	MU_X	MU_X/P_x (A Rupee worth) of MU	MU_Y	MU_Y/P_Y (A Rupee worth) of MU
1	20	20/2 = 10	24	24/3 = 8
2	18	18/2=9	21	21/3=7
3	16	16/2 = 8	18	18/3=6
4	14	14/2 = 7	15	15/3 = 5
5	12	12/2 = 6	12	12/3 = 4
6	10	10/2=5	9	9/3=3

For obtaining maximum satisfaction from spending his income of ₹ 24, the consumer will buy 6 units of X by spending ₹ 12 (₹ 12 = 2 × 6) and 4 units of Y by spending ₹ 12 (₹ 12 = 2 × 6). This combination of goods brings him maximum satisfaction (or state of equilibrium) because a rupee worth of MU in case of good X is 5 (MUx/Px = 10/2) and in case of good Y is also 5

(MU_Y/P_Y = 15/3)

(= MU of last rupee spent on each good)

It should be noted that, consumer's maximum satisfaction is subject to-budget constraints i.e. the amount of money to be spent by the consumer (₹ 24 in this example)



What happens when the consumer is not in equilibrium?

Suppose, MUx/Px is greater than MUy/Py. This means that MU from last rupee spent on X is greater than the MU of the last rupee spent on Y. This induces the consumer to transfer his expenditure from Y to X. As a consequence, MUx falls and MU rises. The act of transfer of expenditure continues until MUx/Px becomes equal to MUy/Py.

14.7 LIMITATION OF UTILITY ANALYSIS

In the utility analysis, it is assumed that utility is cardinally measurable, i.e., it can be expressed in quantitative term. However, utility is a feeling of mind and there cannot be a standard measure of what a person feels. So, utility cannot be expressed in figures.

INTEXT QUESTIONS 14.2

1. State the necessary condition for consumer's equilibrium in case of a single good.
2. What are necessary conditions for consumer's equilibrium in case of two goods?

14.8 ORDINAL UTILITY APPROACH (INDIFFERENCE CURVE ANALYSIS)

You have already studied the utility approach which was based on the assumption that utility is measurable numerically (like 1 util, 2 utils, 3 utils). This is called cardinal utility approach. **Prof. J.R.** Hicks criticized the utility approach as unrealistic because satisfaction (utility) is a subjective phenomenon and so it can never be measured precisely. He, therefore, presented an alternative technique known as indifference curve approach (also called ordinal utility approach). It is based on the assumption that every consumer has a scale of preference in the form of assigning ranks (like 1st 2nd, 3rd rank) to different combinations of two goods called bundle and can tell which bundle he likes most.

Before we proceed to discuss the consumer's equilibrium through indifference curve approach, let us understand some useful concepts related to indifference curve analysis.

(i) Meaning of Indifference Curve

When a consumer consumes various goods and services, then there are some combinations (bundles) which give him same satisfaction. The graphical representation of such combinations is termed as indifference curve.

An indifference curve is a curve that shows all those combinations (bundles) of two goods which give equal satisfaction to the consumer.

Table 14.4 shows an indifference schedule showing all the combinations of good X and good Y giving 'equal satisfaction to the consumer.

Table 14.4: Indifference Schedule

Combinations	Good X (Units)	Good Y (Units)	Marginal Rate of Substitution (ΔY/ΔX)
A	1	8	–
B	2	4	4Y: 1X
C	3	2	2Y: 1X
D	4	1	1Y : 1X

Combinations A, B, C and D of good X and Y viz. (1X + 8Y), (2X + 4Y), (3X + 2Y) and (4X + 1Y) give the consumer equal satisfaction. In other words, consumer is indifferent between these combinations of good X and good Y. When these combinations are represented graphically, we get an indifference curve as shown in Fig. 14.2.

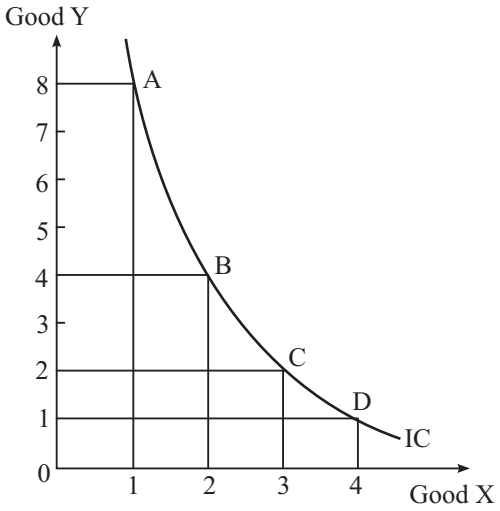


Fig. 14.2

(ii) Monotonic Preferences

Consumer's preferences are called monotonic if and only if between two bundles, consumer prefers the bundle which has more of at least one of the good and no less of other good as compared to other bundles. For example, between the bundles

(2X + 2Y), (1X + 2Y), (2X + 1Y) and (1X + 1Y), the consumer will prefer only bundle (2X + 2Y) to all the three bundles, if his preferences are monotonic.

(iii) Indifference Map

An indifference map is a collection of indifference curves that represent different levels of satisfaction. Higher indifference curves represent higher level of satisfaction because higher indifference curves represent more quantities of both the goods or same quantity of one good and more quantity of other good.

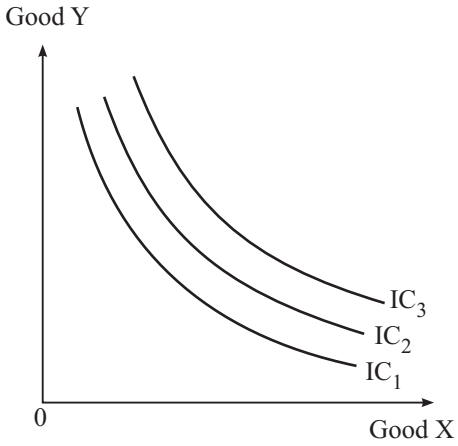


Fig. 14.3 Indifference Map

An indifference map containing three indifference curves IC_1, IC_2 and IC_3, is drawn in Fig. 14.3. All the bundles on IC_2 give more satisfaction to the consumer in comparison to IC_1. Similarly, the bundles on IC_3 give more satisfaction to the consumer in comparison to IC_1 and IC_2. This is a result of monotonic preferences.

(iv) Budget Line

A budget line graphically represents all possible combinations of two goods which a **consumer can buy with his entire income at the prevailing market prices.** Anywhere on the budget line consumer is spending his entire income either on single or both the goods. Suppose, the consumer wants to buy good X and good Y; price of each unit of X is P and that of Y is P_2; Then

Accordingly the expenditure on X will be equal to P_1X and the same on Y will be equal to P_2Y.

Total expenditure on good X and Y will be $P_1X + P_2Y$. Let the money required to buy these goods is denoted as M. So we can write that

$$P_1X + P_2Y = M$$

This is called the equation for budget line.

This is shown in Fig. 14.4

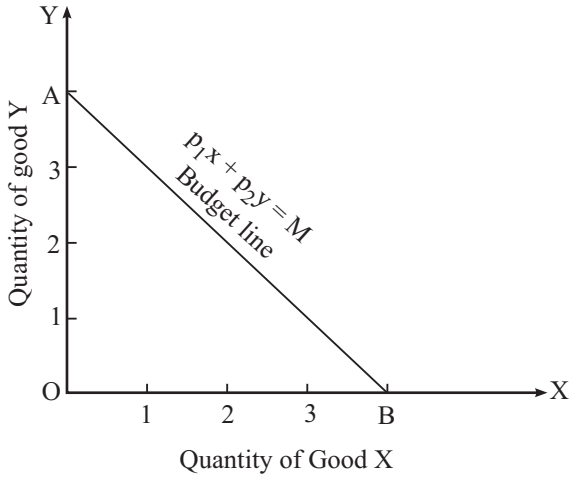


Fig. 14.4

In the Fig. 14.4, AB is the budget line. Point A is located by dividing the entire income over quantity of good Y only. Similarly point B is located by dividing the entire income over quantity of good X only. At any point on the line AB other than, A and B, the consumer can buy certain combination of X and Y by using her income.

A budget line changes when either the prices of the goods or income of the consumer or both changes. A budget line is negatively sloped because to buy more units of a good, consumer must buy less units of other good as consumer's income is fixed.

Slope of budget line = Quantity of other good sacrificed/ Quantity of good obtained = $\Delta Y/\Delta X$

Suppose, price of good X is ₹.2 and that of good Y is Re.1. So, he has to sacrifice 2 units of good Y to obtain one unit of good X. In this example,

Slope of budget line = $\Delta Y/\Delta X$

$= 2/1$

2/1 is nothing but the price ratio between good X and good Y. So the price ratio indicates the slope of budget line. Thus,

Slope of budget line = Px/Py. This is also called market rate of exchange (MRE) because the two goods can be exchanged at this rate, given their prices in the market.

(v) Budget Set

Budget set is the set of all possible combinations of two goods which a consumer can afford, given his income and market prices of the two goods. So, a budget set includes all the bundles of two goods which consumer can afford even if her entire income is not spent.

(vi) Marginal rate of substitution (MRS)

Marginal rate of substitution refers to the rate at which consumer is willing to give up amount of other good to obtain one extra unit of the good in question without affecting total satisfaction. So, the rate of substitution of one commodity for another is called marginal rate of substitution. It is expressed as MRSxy of good X for good Y. Symbolically, MRSxy = Loss of good Y/ Gain of good X = $\Delta Y/ \Delta X$

MRS_{xy} can be explained with the help of Fig. 14.5.

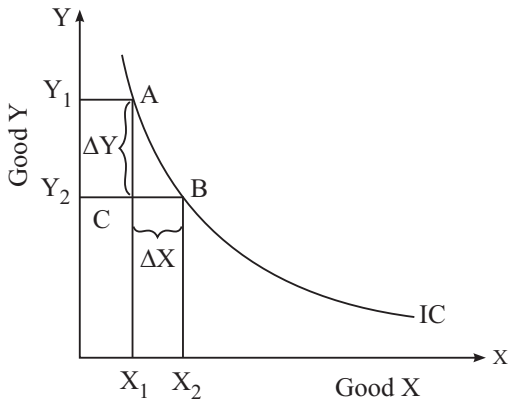


Fig. 14.5

$MRS_{XY} = \Delta Y/\Delta X = AC/CB$

AC/CB is the slope off indifference curve, i.e. slope of indifference curve = MRS_{XY}. As the consumer gets more and more units of good X, marginal utility of good X goes on falling with every increase in units of good X. Simultaneously, the consumer is left with lesser units of good Y. So, marginal utility of Y rises. Therefore, he is willing to give up lesser quantity of good Y for obtaining additional units of good X. Hence MRS diminishes along an indifference curve when we move from upwards to downward.

14.9 PROPERTIES OF INDIFFERENCE CURVES

(i) Indifference Curves are always convex to the origin

Indifference curves are always convex to the origin because of diminishing marginal rate of substitution. As the consumer consumes more and more of one

good, his marginal utility of this good keeps on declining and he is willing to give up less of other good. Therefore, indifference curves are convex to the origin.

(ii) Indifference Curves slope downwards

It implies that as a consumer consumes more of one good, he must consume less quantity of the other good so that the total utility remains the same.

(iii) Higher Indifference Curves represent Higher level of satisfaction

Consider Fig. 14.6

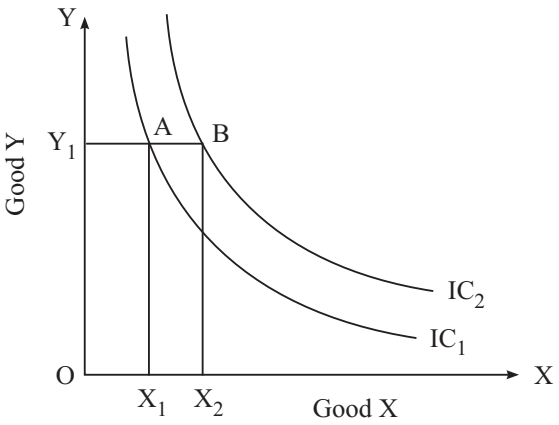


Fig. 14.6

Bundle A on indifference curve IC_1, contains OY_1 quantity of good Y and OX, quantity of good X. Bundle B on indifference curve IC_2 has same quantity i.e. OY_1 of good Y but more quantity i.e. OX_2 of good X. Since, the consumer's preferences are monotonic, he will prefer bundle B to bundle A. It means, higher indifference curves represent higher level of satisfaction.

(iv) Indifference Curves can never Intersect

To analyze this, let us consider Fig. 14.7

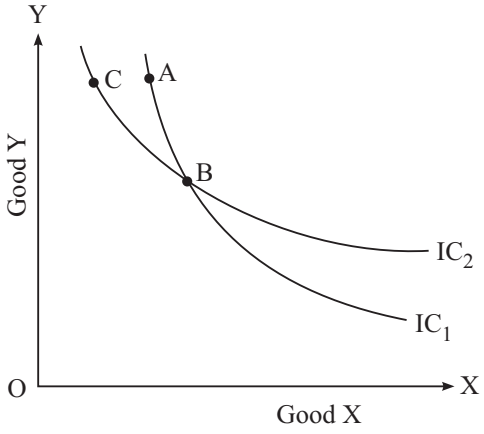
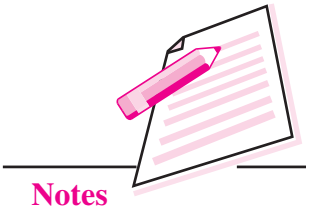


Fig. 14.7



We have two indifference curves that intersect at point B. The consumer is indifferent between bundles A and B as they lie on the same indifference curve IC_1. Similarly, the consumer is indifferent between bundles C and B as they lie on the same indifference curve IC_2. This implies that bundles A and C give the consumer the same level of satisfaction. However, this is not possible as higher indifference curve represents higher level of satisfaction.

14.10 ASSUMPTIONS OF INDIFFERENCE CURVES

Indifference curve analysis is based upon the following assumptions:

(i) It is assumed that the consumer has fixed amount of money whole of which is to be spent on two goods, given the market prices of goods.

(ii) It is assumed that the consumer has not reached the point of satiety. He always prefers more of both the commodities.

(iii) Consumer can rank his preferences on the basis of the satisfaction from each bundle of goods.

(iv) It is assumed that marginal rate of substitution is diminishing.

(v) Consumer is a rational person i.e. he always aims to maximize his satisfaction.

14.11 CONSUMER'S EQUILIBRIUM BY INDIFFERENCE CURVE ANALYSIS

As stated earlier, consumer's equilibrium refers to a situation when he gets maximum satisfaction and he feels no need to change his position, subject to his income and market prices of two goods.

Condition of Consumer's Equilibrium

According to indifference curve approach, a consumer will be at equilibrium when:

(i) Budget line is tangent to the indifference curve.

i.e. slope of budget line = slope of indifference curve

Or, $MRS_{XY} = P_x/P_Y$

Suppose, two goods consumed are X and Y. Further suppose the consumer wants to increase consumption of good X in place of good Y. MRS is the rate/at which consumer is willing to sacrifice amount of Y to get one more unit of X. Market rate of exchange (MRE) is the rate at which consumer has to sacrifice amount of Y to get one more unit of X.

When MRS>MRE, it implies that in order to obtain one unit of X, the consumer is willing to sacrifice more units of Y than the market allows. This will lead to increase in consumption of X but decrease in consumption of Y. MRS starts falling. He continues to consume more of X till MRS becomes equal to MRE.

When MRS<MRE, it implies that inorder to get one more unit of X, the consumer is willing to sacrifice less units of Y than the market requires. He will reduce the consumption of X and increase consumption of Y. MRS Starts rising. He continues reducing consumption of X till MRS becomes equal to MRE.

To study consumer's equilibrium, let us study the Fig. 14.8

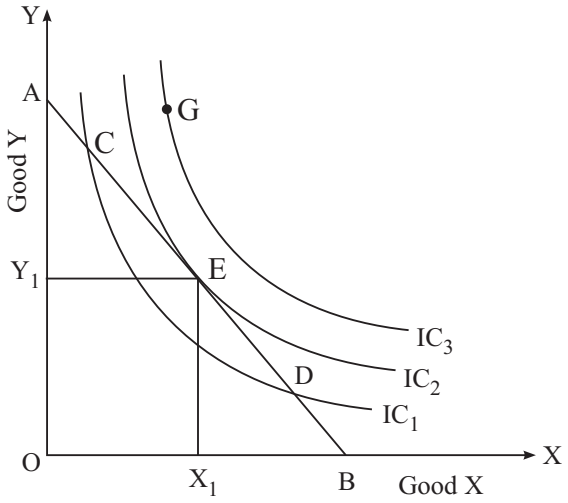


Fig. 14.8

Given the indifference map and the budget line, the consumer is at equilibrium at point E. The consumer obtains maximum satisfaction when, he consumes bundle E containing OX_1 quantity of good X and OY_1 quantity of good Y. At E point budget line is tangent to the indifference curve IC_2, i.e. MRS = MRE= Px/PY Note that the consumer can buy bundles C and D because they also lie on his budget line but these bundles lie on lower indifference curve which represents lower level of satisfaction. He will like to consume bundle G lying on indifference curve IC_3 which represents highest level of satisfaction but it is beyond his budget. So the consumer's equilibrium bundle is X_1, Y_1 at point E where the budget line is tangent to indifference curve.

INTEXT QUESTIONS 14.3

1. What is an indifference curve?
2. Define marginal rate of substitution.
3. What do you mean by monotonic preferences? Give example.
4. State the conditions of consumer's equilibrium in indifference curve approach.

WHAT YOU HAVE LEARNT

- Consumer's equilibrium refers to a situation when he/she spends his/her money income on purchase of a commodity/bundle in such a way that yields him/her maximum satisfaction and he/she feels no urge to change.
- Utility is the power of a commodity to satisfy a want.
- Marginal utility is the addition to the total utility derived from the consumption of an additional unit of a commodity, say good X.

$$MU_X = \frac{\Delta TU}{\Delta X}$$

- Total utility (TU) is the total satisfaction obtained from the consumption of all possible units of a commodity.

  $TU_n = MU_1 + MU_2 + MU_3 + ... MU_n$

- (i) TU increases when MU is positive
  (ii) TU is maximum when MU is zero
  (iii) TU falls when MU is negative
- Law of diminishing marginal utility states that 'as more and more units of a commodity are consumed, marginal utility derived from each successive unit goes on diminishing.'
- In case of a single commodity a consumer will be at equilibrium when marginal utility (in terms of money) equals the price paid for the commodity.

  i.e., $MU_X = P_X$, where X is the commodity.
- In case of two goods, a consumer will be in equilibrium when (i) the ratio of MU of a good to its price equals the ratio of MU of another good to its price, i.e. $MU_X/P_X = MU_Y/P_Y$ = MU of last rupee spent on each good. This is called law of equimarginal utility.
- An indifference curve is a curve that shows all those combinations of two goods which give equal satisfaction to the consumer

Notes

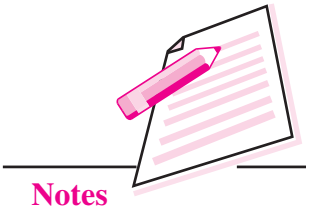
- An indifference map is a collection of indifference curves that represent different levels of satisfaction.-
- A budget line graphically represents all possible combinations of two goods which a consumer can buy with his entire income at the prevailing market prices.
- Budget set is the set of all possible combinations of two goods which a consumer can afford, given his income and market prices of the two goods.
- Marginal rate of substitution refers to the rate at which consumer is willing to give up amount of other good to obtain one extra unit of the good in question without affecting total satisfaction.
- Consumer's preferences are called monotonic if and only if between two bundles, consumer prefers the bundle which has more of at least one of the good and no less of the other good as compared to the other bundles.
- Properties of indifference curves are:
  - (i) Indifference curves are always convex to the origin;
  - (ii) Indifference curves always slope downwards;
  - (iii) Indifference curves never intersect;
  - (iv) Higher Indifference curves represent higher level of satisfaction.
- According to indifference curve approach a consumer will be in equilibrium when,
  - (i) Budget line is tangent to the indifference curve

    or $MRS = P_X/P_Y$

    or MRS = MIRE

TERMINAL EXERCISE

1. What is meant by consumer's equilibrium? Explain the condition of consumer's equilibrium in case of a single commodity using utility approach.
2. Explain the condition determining how many units of a good the consumer will buy at a given price.
3. Explain the relationship between total utility and marginal utility.
4. Explain the law of diminishing marginal utility with the help of a schedule.
5. A consumer buys two goods X and Y. Explain the conditions of his equilibrium using utility approach.



6. A consumer buys two goods X and Y. Explain the conditions of his equilibrium using indifference curve approach.
7. Explain the properties of indifference curves.

ANSWERS TO INTEXT QUESTIONS

14.1

1. Read section 14.1
2. (i) Read section 14.2(i)
   (ii) Read section 14.2(ii)
   (iii) Read section 14.2(iii)
3. Read section 14.3 (Maximum)

14.2

1. Read section 14.5
2. Read section 14.6

14.3

1. Read section 14.8(i)
2. Read section 14.8(vi)
3. Read section 14.8(ii)
4. Read section 14.11

Notes

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15

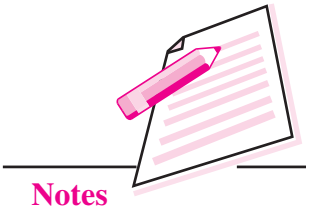
DEMAND

You have already studied in the previous lessons that goods and services have the power to satisfy our wants. We have unlimited wants. Most of them can be satisfied by goods and services. Therefore, we purchase goods and services from the market. Now a days the market is flooded with various types of goods. We cannot purchase all these goods since we have limited money. So, we have to make a choice between what to purchase and what not to purchase. We decide to purchase a good or a combination of goods depending on the amount of money we have and the price we have to pay. All these things are related with the study of **Demand**.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning of demand;
- differentiate between desire, want and demand;
- differentiate between individual demand and market demand;
- explain the factors that affect individual demand and market demand for a commodity;
- explain the Law of Demand;
- identify the reasons of law of demand as well as exception to law of deamand;
- prepare a hypothetical individual demand schedule and draw an individual demand curve;
- prepare a market demand schedule and draw a market demand curve; and
- Differentiate between movement along the demand curve and shift in the demand curve.



15.1 MEANING OF DEMAND

It is commonly observed that people alternatively use the terms desire, want and demand. In economics, they are not same. Desire means merely a wish to have a commodity. It is simply craving for a commodity. So any body can desire anything, irrespective of whether that thing is really available or not. On the otherhand, want is the desire which is backed by ability and willingness to pay. So every desire is not a want. Desire becomes a want only when the person is in a position to satisfy it.

By demand for a commodity we **mean** the desire for the commodity backed by purchasing power and the willingness to spend. When a consumer wishes to consume a commodity and has also the necessary purchasing power i.e. income along with willingness to spend, he is said to have demand for the commodity.

Demand for a commodity refers to the quantity of a commodity that a consumer is willing to buy at a given price during a given period of time.

The definition of demand highlights three essential elements of demand:

(i) price of the commodity

(ii) quantity of the commodity

(iii) period of time: the time period may be a day, a week, a month, a year or any other period.

Let us consider the following statements:

(i) Mr. Akshay purchased 2kgs. apples last week.

(ii) Mr. Akshay purchased 2Kgs. apples when the price of apples was ₹ 60 per kg.

(iii) Mr. Akshay purchased 2Kgs. apples last week when the price of apples was ₹ 60 per Kg.

The first two statements are incomplete in context of demand. In the first statement the price of apples is not stated. In the second statement period of time is not stated. The third statement is complete as it states the quantity of the apples, the price of apples and the time period during which the said quantity is demanded.

15.2 INDIVIDUAL DEMAND AND MARKET DEMAND

Individual demand for a commodity refers to the quantity of the commodity that an individual buyer is willing to buy at a given price during a given period of time. In the example given in the beginning of the lesson Akshay's demand for apple is the individual demand for apple.

Notes

But Akshay is not the only buyer of apple in the market. There may be other persons who may demand apples in the market. Let us assume that besides Akshay there are three more buyers of apples in the market Rohit, Ritik and Ajai. Market demand for apples will be the sum of demand of all the buyers of apples at a given price during a given period of time. Suppose, when price of apples is ₹ 60 per Kg., Akshay buys 2 Kgs. , Rohit buys 3 Kgs. , Ritik buys 2.5 Kgs. and Ajai buys 1.5 Kgs. of apples during a week then market demand for apples will be 2 + 3 + 2.5 + 1.5 = 9 kgs. at price ₹ 60 per kg.

Thus, **market demand** for a good means the total quantity of a commodity that all the buyers of the good are willing to buy at a given price over a given time period.

INTEXT QUESTIONS 15.1

1. What is meant by demand for a commodity?
2. What are the three essential elements of demand?
3. How does a desire differ from demand?
4. Distinguish between individual demand and market demand?

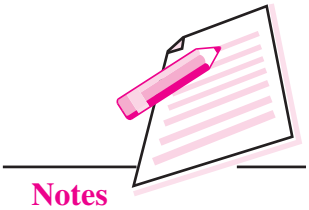
15.3 FACTORS AFFECTING INDIVIDUAL DEMAND FOR A COMMODITY

The factors that influence a consumer's decision to purchase a commodity are also known as determinants of demand. The following factors affect the individual demand for a commodity:

1. price of the commodity
2. price of related goods
3. income of buyer of the commodity
4. tastes and preferences of the buyer

1. Price of the Commodity

You must have observed that when price of a commodity falls, you tend to buy more of it and when its price rises, you tend to buy less of it, when all other factors remain constant ('other things remaining the same'). In other words, **other things remaining the same, there is an inverse relationship between the price of a commodity and its quantity demanded by its buyers.** This statement is in accordance with law of demand which you will study in the later part of this lesson.



Price of a commodity and its quantity demanded by its buyers are inversely related only when 'other things remain the same'. So, 'other things remaining the same' is an assumption when we study the effect of changes in the price of a commodity on its quantity demanded.

2. Price of Related goods

A consumer may demand a particular good. But while buying that good he/she also asks the price of its related goods.

Related goods can be of two types-

(i) Substitute goods

(ii) Complementary goods

While purchasing a good, prices of its substitutes and complements do affect its quantity purchased.

(i) Price of Substitute Goods: Substitute goods are those goods which can easily be used in place of one another for satisfaction of a particular want, like tea and coffee. An increase in price of substitute good leads to an increase in demand for the given commodity and a decrease in price of substitute good leads to a decrease in demand for the given commodity. It means demand for a given commodity is directly affected by change in price of substitute goods. For example, if price of coffee increases, the demand for tea will rise as tea will become relatively cheaper in comparison to coffee.

(ii) Price of Complementary goods: Complementary goods are those goods which are used together to satisfy a particular want like car and petrol**.** An increase in the price of complementary goods leads to a decrease in demand for the given commodity and a decrease in the price of complementary goods leads to an increase in demand for the given commodity. For example, if price of petrol falls then the demand for cars will increase as it will be relatively cheaper to use both the goods together. So, demand for a given commodity is inversely affected by change in price of complementary goods.

3. Income of the Buyer of Commodity

Demand for a commodity is also affected by income of its buyer. However, the effect of change in income on demand depends on the nature of the commodity under consideration.

In case of some goods like full cream milk, fine quality of rice (Basmati rice) etc, demand for these commodities increases when income of the buyer increases and demand for these commodities decreases when income of the buyer decreases. Such goods, whose demand increases with the increase in income of the buyer, are called **normal goods.** But there are some goods like coarse rice, toned milk etc.

Notes

whose demand decreases when income of buyer increases and their demand increases when income of the buyer decreases. Such goods, whose demand decreases with the increase in income of the buyer, are called **inferior goods**. Suppose, a consumer buys 10 Kgs. of rice whose price is ₹ 25 per Kg. He cannot afford to buy better quality of rice because the price of such rice is ₹ 50 per Kg. The consumer is spending ₹ 250 per month on the purchase of rice. Now, if income of the consumer increases and he can afford ₹ 350 on purchase of 10 Kg. of rice. Now he can afford to buy some quantity of rice, say 6 Kgs., whose price is ₹ 25 per Kg. and may buy 4 Kgs. of rice whose price is ₹ 50 per Kg. Thus he will buy 10 Kgs. of rice by spending ₹ 350 per month.

Therefore, we may conclude that demand for normal goods is directly related to the income of the buyer but demand for inferior goods is inversely related to the income of the buyer.

4. Tastes and Preferences of the Buyer

The demand for a commodity is also affected by the tastes and preferences of the buyers. They include change in fashion, customs, habits etc. Those commodities are preferred by the consumers which are in fashion. So, demand for those commodities rises which are in fashion. On the other hand, if a commodity goes out of the fashion, its demand falls because no consumer will like to buy it.

15.4 FACTORS AFFECTING MARKET DEMAND FOR A COMMODITY

As stated earlier market demand is the total quantity of a commodity that all its buyers taken together are willing to buy at a given price during a given period of time. In addition to the factors affecting individual demand for a commodity, market demand is also influenced by the following factors:

(i) Number of Buyers in the Market(Population)

Increase in population raises the market demand, whereas decrease in population reduces the market demand for a commodity. Not only the size of population but its composition like age (ratio of males, females, children and old people in population) also affects the demand for a commodity. It is because of needs of children, young, old, male and female population differ.

(ii) Distribution of Income and Wealth

If the distribution of income and wealth is more in favour of the rich, demand for the commodities preferred by the rich such as comforts and luxuries is likely to be higher. On the other hand, if the distribution of income and wealth is more in favour of poor, demand for commodities preferred by the poor such as necessities will be more.

(iii) Season and Weather Conditions

This is generally observed that the demand for woolens increases during winter whereas, demand for ice creams and cold drinks increases during summer. Similarly, market demand for umbrellas, rain coats increases during rainy season.

INTEXT QUESTIONS 15.2

1. What are substitute goods? Give one example of substitute goods.
2. What are inferior goods? Give one example of inferior goods.
3. What are normal goods? Give one example of normal goods.

15.5 LAW OF DEMAND

We have already studied about the effect of change in price on demand for a commodity. The law of demand explains the relationship of price of a commodity and its quantity demanded, when all other factors affecting demand remain constant.

The law of demand states that **other things remaining same, quantity demanded of a commodity is inversely related to its price.** In other words, demand for a commodity rises when its price falls and its demand falls when price rises provided other factors remain unchanged.

The law of demand can better be explained with the help of table 15.1 and figure 15.1

Table 15.1

Price (In ₹)	Quantity Demanded (In Units)
1	10
2	8
3	6
4	4
5	2

As you see in table 15.1 when price of the commodity rises, quantity demanded decreases.

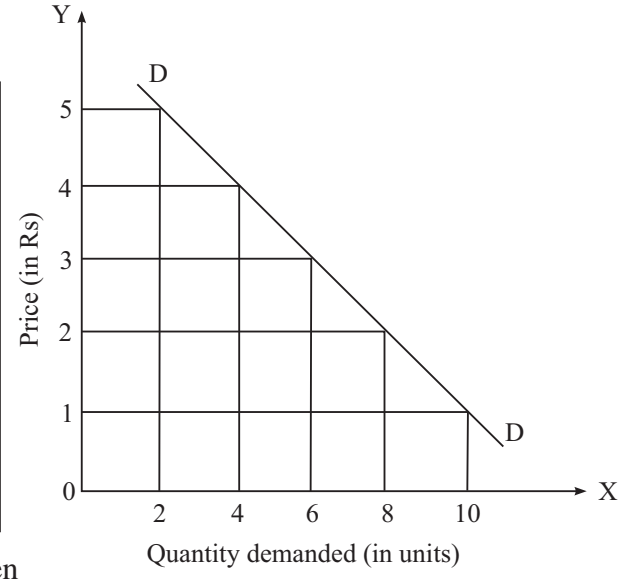


Fig. 15.1

Notes

That is why the demand curve slopes downwards from left to right as shown in Fig. 15.1. Downward slope of demand curve shows the inverse relationship of price and quantity demanded of a commodity.

15.6 ASSUMPTIONS OF LAW OF DEMAND

In law of demand all other factors except price of the commodity are assumed to be constant. Therefore, we use the phrase 'other things remaining same'. This phrase is used to cover the following assumptions on which the law is based:

1. Prices of substitute goods do not change.
2. Prices of complementary goods do not change.
3. Income of the buyer remains the same.
4. There is no change in tastes and preferences of the buyer.

15.7 REASONS FOR OPERATION OF LAW OF DEMAND

Now we will try to explain why does a consumer purchase more quantity of a commodity at a lower price and less of it at a higher price or why does the law of demand operate i.e. why does the demand curve slope downwards from left to right. The main reasons for operation of law of demand are:

1. Law of Diminishing Marginal Utility

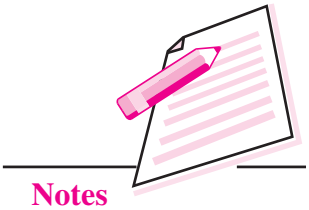
As you have studied earlier, law of diminishing marginal utility states that as we consume more and more units of a commodity, the utility derived from each successive unit goes on decreasing. The consumer will be ready to pay more for those units which provide him more utility and less for those which provide him less utility. It implies that he will purchase more only when the price of the commodity falls.

2. Income Effect

When price of a commodity falls, purchasing power or real income of the consumer increases which enables him to purchase more quantity of the commodity with the same money income. Let us take an example. Suppose you buy 4 ice creams when price of each ice cream is ₹ 25. If price of ice creams falls to ₹ 20, then with same money income you can buy 5 ice creams now.

3. Substitution Effect

When price of a commodity falls, it becomes comparatively cheaper as compared to its substitutes (although price of substitutes has not been changed). This will lead to rise in demand for the given commodity. For example, if coke and Pepsi



both are sold at ₹ 10 each and price of coke falls. Now coke has become relatively cheaper and will be substituted for Pepsi. It will lead to rise in demand for coke.

4. Change in Number of Buyers

When price of a commodity falls, some old buyers may demand more of the commodity at the reduced price and some new buyers may also start buying this commodity who were not in a position to buy it earlier due to higher price. This will lead to increase in number of buyers when price of the commodity falls. As a result demand for the commodity rises when its price falls.

5. Diverse Uses of a Commodity

Some commodities have diverse uses, like milk. It can be used for drinking, for sweet preparation, for ice cream preparation etc. If price of milk rises, its use may be restricted to important purpose only. This will lead to reduction in demand for other less important uses. When price of milk falls, it can be put to other uses also leading to rise n demand for it.

15.8 EXCEPTIONS TO THE LAW OF DEMAND

You have studied in law of demand that a buyer is willing to buy more quantity of a commodity at a lower price and less of it at a higher price. But in certain circumstances, a rise in price may lead to rise in demand. These circumstances are called Exceptions to the Law of Demand. Some important exceptions are:

1. Giffen Goods

Giffen goods are special type of inferior goods in which negative income effect is stronger than negative substitution effect. Giffen goods do not follow law of demand as their demand rises when their price rises. Examples of Giffen goods are jowar and bajra etc.

2. Status Symbol Goods

Some goods are used by rich people as status symbols, e.g. diamonds, gold jewellary etc. The higher the price, the higher will be the demand for these goods. When price of such goods falls, these goods are no longer looked at as status symbol goods and, tehrefore, therir demand falls.

3. Necessities

Commodities such as medicines, salt, wheat etc. do not follow law of demand because we have to purchase them in minimum required quantity, whatever their price may be.

4. Goods Expected to be Scarce

When the buyers expect a scarcity of a particular good in near future, they start buying more and more of that good even if their prices are rising. For example, during war, famines etc. people tend to buy more of some goods even at higher prices due to fear of their scarcity in near future.

INTEXT QUESTIONS 15.3

1. State the law of demand.
2. State any two assumptions of law of demand.
3. State any two exceptions of law of demand.

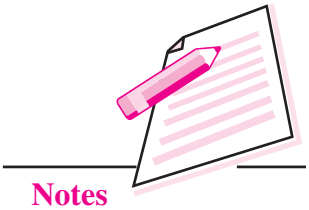
15.9 INDIVIDUAL DEMAND SCHEDULE

In law of demand you have studied that other things remaining same, quantity demanded of a commodity is inversely related to its price. This inverse relationship of price and quantity demanded by an individual buyer can also be explained with the help of a schedule. **Individual demand schedule shows different quantities of a commodity demanded by an individual buyer at different prices. Such a schedule is given in table 15.2.**

Table 15.2 Individual Demand for Apples

Price of Apples Per kg. (₹)	Quantity Demanded of Apples (per week) (In kgs.)
90	1
80	2
70	3
60	4
50	5

The above schedule shows that when price of apples is ₹ 90 per Kg. quantity demanded is 1 Kg. per week. But when price falls to ₹ 80, ₹ 70, ₹ 60 and ₹ 50 per Kg. quantity demanded increases to 2 Kgs., 3 Kgs., 4 Kgs. and 5 Kgs. per week respectively. **So, the demand schedule is a tabular statement of law of demand. Demand schedule shows different quantities of a commodity demanded at different prices in tabular form.**



15.10 INDIVIDUAL DEMAND CURVE

Demand curve is a diagrammatic presentation of law of demand. If we plot the individual demand schedule on the graph paper, we will get a curve which is called as individual demand curve. Individual demand curve is shown in Fig. 15.2.

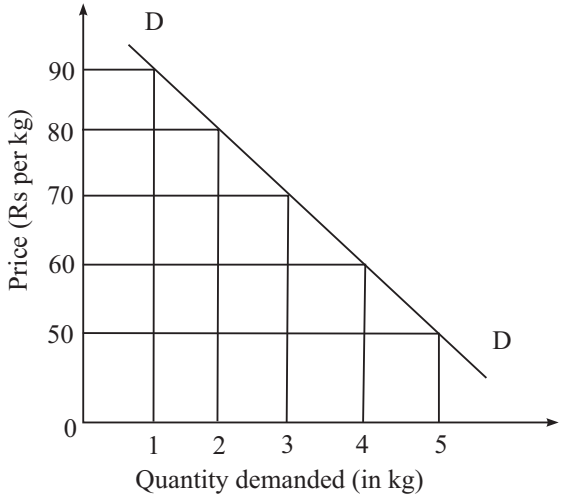


Fig. 15.2: Individual demand curve

As seen in the diagram, price is taken on Y-axis and quantity demanded on X-axis. Points A, B, C, E and F represent five combinations of price and quantity demanded of apples given in table 15.2. Point A shows that at the price of ₹ 90 per Kg. the quantity demanded of apples is 1 Kg. per week, Point B shows the quantity demanded is 2 Kgs. per week when the price is ₹ 80 per Kg. Similarly, the other combinations of price and quantities demanded of apples as given in table 15.2 are shown as points C, E and F. By joining these points individual demand curve for apples has been derived.

15.11 MARKET DEMAND SCHEDULE

As explained earlier, market demand is the total quantity of a commodity that all its buyers taken together are willing to buy at a given price during a given period of time. From the individual demand schedules of a commodity, we can prepare the market demand schedule of that commodity. We assume that there are only three buyers A, B and C of apples in the market. The demand schedules of these buyers are given in table 15.3.

Table 15.3: Market Demand for Apples

Price of Apples	Quantity Demanded of Apples per week (In kgs.)			Market Demand of Apples per week (In kgs.)
	A	B	C	M.D. = A + B + C
90	1	3	2	1 + 3 + 2 = 6
80	2	5	3	2 + 5 + 3 = 10
70	3	7	4	3 + 7 + 4 = 14
60	4	9	5	4 + 9 + 5 = 18
50	5	11	6	5 + 11 + 6 = 22

When price of apples is ₹ 90 per Kg. A demands 1 Kg. of apples, B demands 3 Kgs. of apples and C demands 2 Kgs. of apples. Thus market demand for apples at a price of ₹ 90 per Kg. is 1 + 3 + 2 = 6 Kgs. per week. Likewise, market demand for apples can be obtained at other prices also as shown in table 15.3.

15.12 MARKET DEMAND CURVE

Just as we plotted the individual demand curve on a graph paper, if we now plot the market demand schedule given in table 15.3, we will get the following figure 15.3.

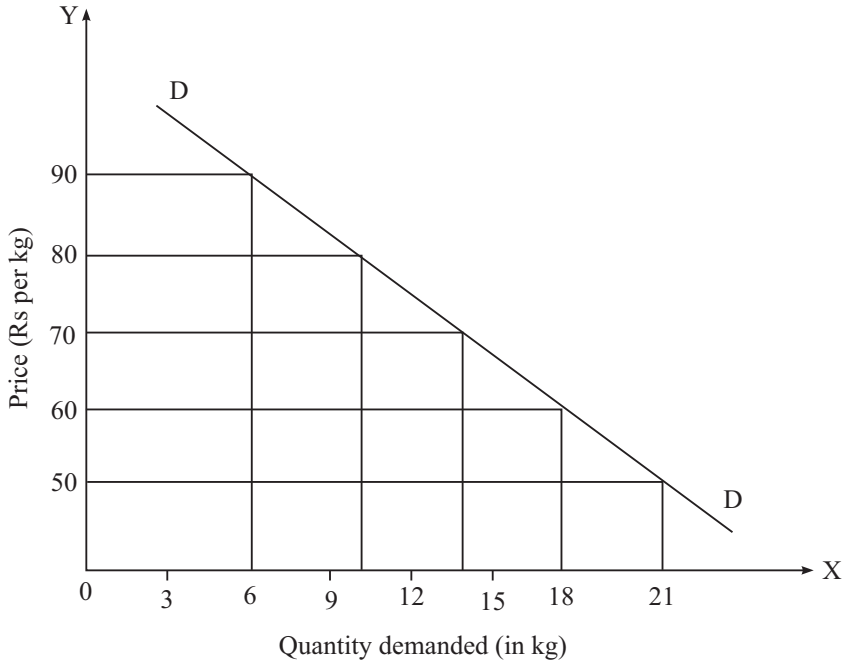
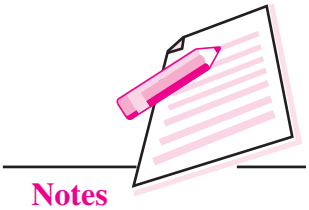


Fig. 15.3



In Figure 15.3 points F, G, H, I and J show the quantity demanded of apples per week in the market at each of the price given in schedule 15.3. Point F shows that the market demand per week of apples is 6 Kgs when the price of apples is ₹ 90 per Kg. Similarly, the other combinations of price and quantity demanded of apples as given in table 15.3 are shown as points G, H, I and J. By joining these points market demand curve for apples can be obtained. Thus, market demand curve is a horizontal summation of individual demand curves.

15.13 MOVEMENT ALONG THE DEMAND CURVE (CHANGE IN QUANTITY DEMANDED)

In law of demand you have already studied the inverse relationship between price and quantity demanded. When quantity demanded of a commodity changes due to change in its price, keeping other factors constant, it is called change in quantity demanded. It is graphically expressed as a **movement along the same demand curve**.

There can be either a downward movement or an upward movement along the same demand curve. Upward movement along the same demand curve is called **contraction of demand or decrease in quantity demanded** and downward movement along the same demand curve is known as **expansion of demand or increase in quantity demanded.** These can better be explained with the help of Fig. 15.4.

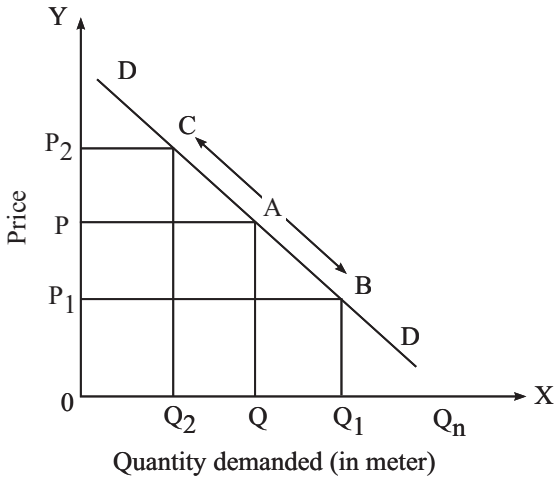


Fig. 15.4: Movement along the demand curve

A fall in price from OP to OP_1 leads to increase in quantity demanded from OQ to OQ_1 (expansion of demand) resulting in a downward movement from point A to point B along the same demand curve DD.

Notes

When Price rises from OP to OP_2, quantity demanded falls from OQ to OQ_2 (contraction of demand) leading to an upward movement from point A to point C along the same demand curve DD.

Expansion of demand and contraction of demand can also be explained through a demand schedule.

See the following demand schedules of apples in table 15.4 and 15.5:

Table 15.4 Expansion of Demand

Price of apples (₹ Per kg.)	Quantity Demanded of apples per week (In kg.)
70	3
60	4
50	5

As seen in table 15.4, as price of apples falls, quantity demanded of apples increases, showing expansion of demand. This is also called increase in quantity demanded.

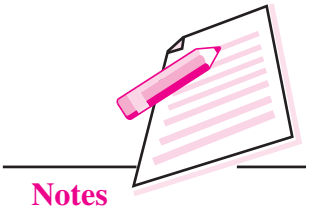
Table 15.5 Contraction of Demand

Price of apples (₹ Per kg.)	Quantity Demanded of apples per week (In kg.)
70	3
80	2
90	1

You can see in table 15.5 when price of apples rises, quantity demanded falls showing contraction of demand. This is also called decrease in quantity demanded.

15.14 SHIFT IN DEMAND CURVE (CHANGE IN DEMAND)

In law of demand all factors other than price of the commodity are assumed to be constant. But what happens when other factors determining demand change but price remains constant? When the demand of a commodity changes at the same price, it means the change is due to change in anyone or more of the other factors that affect demand. **When the demand for a commodity changes due to change in any factor other than the price of the commodity, it is known as change n demand.** It is graphically expressed as **shift in demand curve.**



Demand curve of a commodity may shift due to change in price of substitute good, change in price of complementary goods, change in income of the buyer, change in tastes and preferences, change in population, change in distribution of income, change in season and weather etc.

The shift in demand curve can be explained with the help of Fig. 15.5:

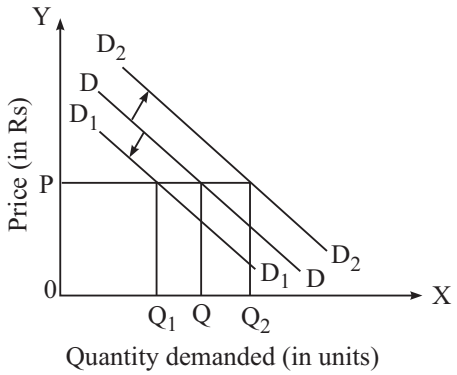


Fig. 15.5: Shift in demand curve

You can see in fig. 15.5 that quantity demanded decreases from OQ to OQ_1 at the same price OP. This decrease is due to unfavourable change in factors other than price of the commodity. This is called **decrease in demand.** When there is decrease in demand, the demand curve shifts towards left.

When quantity demanded increases from OQ to OQ_2 at same price OP, this is called **increase in demand.** Increase in demand is due to favourable change in factors other than price of the commodity. In case of increase in demand, the demand curve shifts towards right.

Increase in demand and decrease in demand can also be explained with the help of demand schedules. Table 15.6 explains increase in demand:

Table 15.6 Increase in Demand

Price of Apples (₹ Per Kg.) (1)	Quantity Demanded of Apples (In kgs.) (2)	Quantity Demanded of Apples (In kgs.) (3)
90	1	2
80	2	3
70	3	4

Notes

If you study table 15.6, you will find that at a price of ₹ 90per Kg. quantity demanded of apples rises from 1 Kg. to 2 Kg. Similarly at all other prices the quantity demanded of apples is more in column 3. This rise in demand is due to change in factors other than price of the commodity.

In the same way, we can prepare a demand schedule for decrease in demand. Table 15.7 explains decrease in demand:

Table 15.7 Decrease in Demand

Price of Apples (₹ Per kg.) (1)	Quantity Demanded of Apples (In kgs.) (2)	Quantity Demanded of Apples (In kgs.) (3)
70	3	2
60	4	3
50	5	4

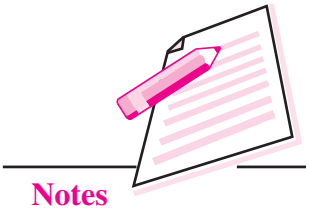
Quantities of apples shown in column (3) of the table show the fall in demand at the same price. This fall in demand is due to unfavorable change in factors other than price of the commodity.

INTEXT QUESTIONS 15.4

1. What is a demand schedule?
2. Complete the following table:

Price (₹ Per Unit)	Quantity Household	Demanded Household	(Units) Household	Market Demand (Units)
	A	B	C	
1	15	20	16	–
2	12	18	13	–
3	9	16	10	–
4	6	14	7	–
5	3	12	4	–

3. What is meant by expansion of demand of a commodity?
4. State any two factors which may lead to increase in demand for a commodity?



WHAT YOU HAVE LEARNT

- Demand for a commodity is the quantity of a commodity that a consumer is willing to buy at a given price during a given period of time.
- Desire means a mere wish to have a commodity. Want is that desire which is backed by the ability and willingness to satisfy it. Demand is the want of a commodity at a given price during a given period of time.
- The main determinants of individual demand are: (i) Price of the commodity (ii) Price of related goods (iii) Income of the buyer and (iv) Tastes and preferences of the buyer.
- In addition to the factors affecting individual demand, market demand for a commodity is also affected by (i) Number of buyers in the market (ii) Distribution of income and wealth and (iii) Season and weather etc.
- The law of demand states that other things remaining same, quantity demanded of a commodity is inversely related to its price.
- The demand curve slopes downwards from left to right due to (i) Law of diminishing marginal utility (ii) Income effect (iii) Substitution effect (iv) Change in number of buyers and (v) Diverse uses of a commodity.
- Exceptions to the law of demand are: (i) Giffen goods (ii) Status symbol goods (iii) Necessities (iv) Goods expected to be scarce.
- Demand schedule is a tabular statement of different quantities of a commodity demanded at different prices.
- Individual demand schedule shows different quantities of a commodity demanded by an individual buyer and market demand schedule is an aggregate of all individual demand schedules in the market.
- Demand curve is a diagrammatic representation of law of demand.
- Individual demand curve shows different quantities of a commodity demanded by an individual buyer in a diagrammatic form. Market demand curve is a sum of horizontal slopes of all individual demand curves.
- When the quantity demanded of a commodity rises due to fall in price of a commodity, it is called expansion of demand or increase in quantity demanded.
- When the quantity demanded of a commodity falls due to rise in its price of a commodity, it is called contraction of demand or decrease in quantity demanded.
- In case of expansion of demand, there is a downward movement along the same demand curve and in case of contraction of demand, there is an upward movement along the same demand curve.

- When the quantity demanded of a commodity rises due to change in factors other than price of the commodity, it is called increase in demand.
- When the quantity demanded of a commodity falls due to change in factors other than price of the commodity, it is called decrease in demand.
- In case of increase in demand, the demand curve shifts towards right. In case of decrease in demand, the demand curve shifts towards left.

TERMINAL EXERCISE

1. What is meant by the term 'demand'?
2. Distinguish between 'desire', want and 'demand' with suitable example.
3. Explain the factors affecting individual demand for a commodity.
4. How is demand for a commodity affected by increase in income of its buyer?
5. Distinguish between (i) Substitute goods and complementary goods (ii) Normal goods and inferior goods
6. State and explain the law of demand.
7. What are the reasons of law of demand?
8. Explain any three conditions in which law of demand does not operate.
9. Distinguish between expansion of demand and increase in demand.
10. Distinguish between contraction of demand and decrease in demand.

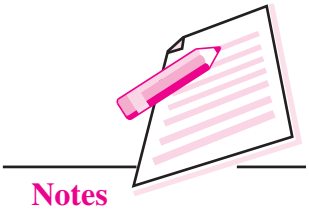
ANSWERS TO INTEXT QUESTIONS

15.1

1. Read section 15.1
2. Read section 15.1
3. Read section 15.2
4. Read section 15.3

15.2

1. Read section 15.4
2. Read section 15.4
3. Read section 15.4



15.3

1. Read section 15.6
2. Read section 15.7
3. Read section 15.9

15.4

1. Read section 15.10
2. 51, 43, 35, 27, 19
3. Read section 15.14
4. Read section 15.15

Notes

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16

PRICE ELASTICITY OF DEMAND

You learnt that the law of demand which explains the inverse relationship between price and quantity demanded of a commodity. The law of demand explains only direction of change in quantity demanded but does not tell us by how much amount the quantity demanded changes due to change in the price. The response of quantity demanded to change in price of the commodity differs in different cases. This forms the subject matter of the study of price elasticity of demand.

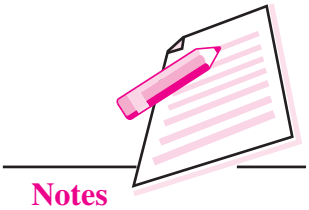
OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning of elasticity of demand;
- explain the meaning of price elasticity of demand, income elasticity of demand and cross elasticity of demand;
- explain various degrees (types) of price elasticity of demand;
- explain methods of calculating price elasticity of demand;
- solve practical problems based on price elasticity of demand; and
- identify factors affecting price elasticity of demand.

16.1 MEANING OF ELASTICITY OF DEMAND

Demand for a commodity is affected by many factors such as its price, price of related goods, income of its buyer, tastes and preferences etc. Elasticity means degree of response. Elasticity of demand means degree of responsiveness of demand. Demand for a commodity responds to change in price, price of related goods, income etc. So, we have three dimensions of elasticity of demand:



(i) Price elasticity of demand: Price elasticity of demand means degree of responsiveness of demand for a commodity to the change in its price. For example, if demand for a commodity rises by 10% due to 5% fall in its price,

Price elasticity of demand (e_p)

$$= \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of the commodity}}$$

$$= \frac{10}{(-)5} = (-)2$$

Note that e_p will always be negative due to inverse relationship of price and quantity demanded.

(ii) Income elasticity of demand: Income elasticity of demand refers to the degree of responsiveness of demand for a commodity to the change in income of its buyer. Suppose, income of buyer rises by 10% and his demand for a commodity rises by 20%, then,

Income elasticity of demand (e_y)

$$= \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price of the commodity}}$$

$$= \frac{20}{10} = 2$$

(iii) Cross Elasticity of demand: Cross elasticity of demand means the degree of responsiveness of demand for a commodity to the change in price of its related goods (substitute goods or complementary goods). Suppose, demand for a commodity rises by 10% due to 5% rise in price of its substitute good, then

Cross elasticity of demand (e_c)

$$= \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price of related good}}$$

$$= \frac{10}{5} = 2$$

(Tastes and preferences cannot be expressed numerically. So elasticity of demand cannot be numerically expressed.)

16.2 DEGREES (TYPES) OF PRICE ELASTICITY OF DEMAND

You must have noticed that when price of salt rises, we go on consuming the same quantity of salt. In other words, quantity demanded of salt does not respond to the change in its price. But what happens when price of apples rises? We start purchasing less quantity of apples at higher price i.e. demand for apples responds when their price changes. So, degree of responsiveness of quantity demanded to a change in price may differ i.e. elasticity of demand could also differ. In this context, the price elasticity of demand is generally classified into following five categories:

(i) Perfectly inelastic demand ($e_d = 0$) : The demand for a commodity is called perfectly inelastic when quantity demanded does not change at all in response to change in its prices (See table 16.1). Graphically, the demand curve in parallel to y-axis as shown in Fig. 16.1.

Table 16.1

Price (₹ Per kg.)	Quantity demanded (In kgs.)
10	2
15	2
20	2

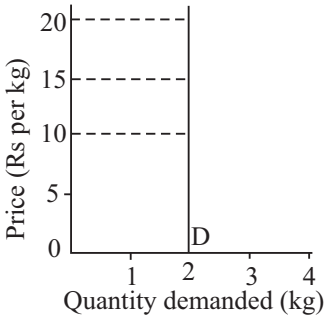


Fig. 16.1

(ii) Less than unit elastic demand ($e_d < 1$) : The demand for a commodity is called less than unit elastic or relatively inelastic when the percentage change in quantity demanded is less than the percentage change in price of the commodity (See table 16.2). Graphically, demand curve is steeper as shown in Fig. 16.2. The demand for necessary goods like medicines and food items etc. is less than unit elastic.

Table 16.2

Price (₹ Per kg.)	Quantity demanded (In kgs.)
10	4
20	3

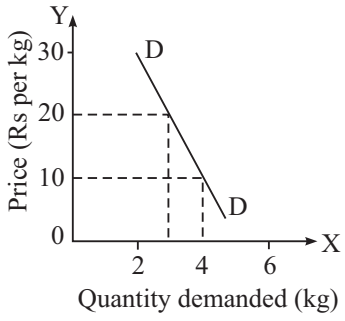
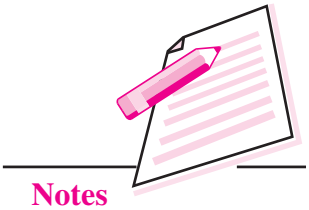


Fig. 16.2



You can see in table 16.2 that fall in quantity demanded is 75% in response to rise in price by 100%.

(iii) Unit elastic demand ($e_d = 1$): When percentage change in quantity demanded of a commodity equals percentage change in its price, the demand for the commodity is called unit elastic (See table 16.3). Graphically, demand curve is rectangular hyperbola as shown in fig. 16.3

(Rectangular hyperbola is a curve on which all the rectangles formed on the curve have same area).

Table 16.3

Price (₹ Per meter)	Quantity demanded (In meters)
20	40
30	20

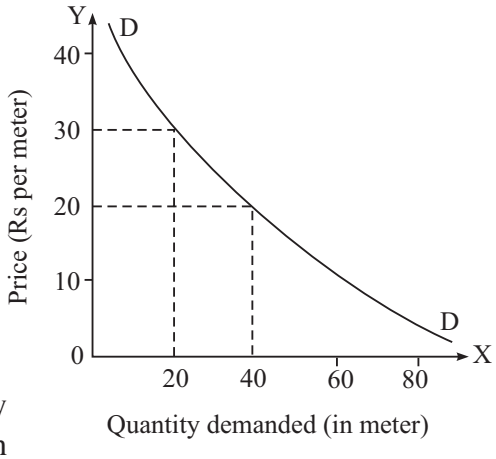


Fig. 16.3

You can see in table 16.3 that fall in quantity demanded is 50% in response to rise in price by 50%.

(iv) More than unit elastic demand ($e_d > 1$): When the percentage change in quantity demanded of a commodity is more than the percentage change in its price, the demand for the commodity is called more than unit elastic or highly elastic (see table 16.4). Graphically, the demand curve is flatter as shown in fig. 16.4. The demand for luxury goods is more than unit elastic.

Table 16.4

Price (₹ Per unit)	Quantity demanded (In units)
100	400
150	100

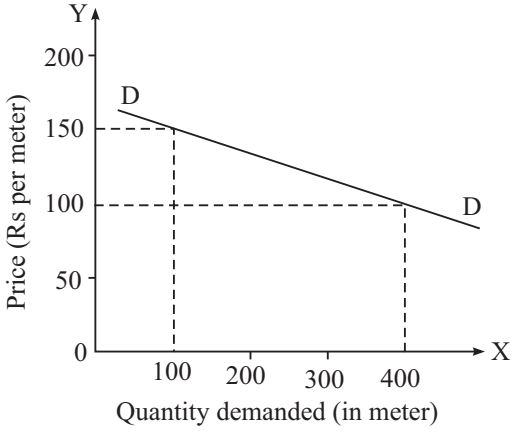


Fig. 16.4

In table 16.4 the quantity demanded has fallen by 75% in response to 50% rise in the price of the commodity.

(v) Perfectly elastic demand ($e_d = \infty$): The demand for the commodity is called perfectly elastic when its demand expands or contracts to any extent without

or very little change in its price (see table 16.5). Graphically, the demand curve is parallel to X-axis as shown in Fig. 16.5.

Table 16.5

Price (₹ Per unit)	Quantity demanded (In units)
20	2
20	4

In table 16.5 the quantity demanded of the commodity rises by 100% without change in its price.

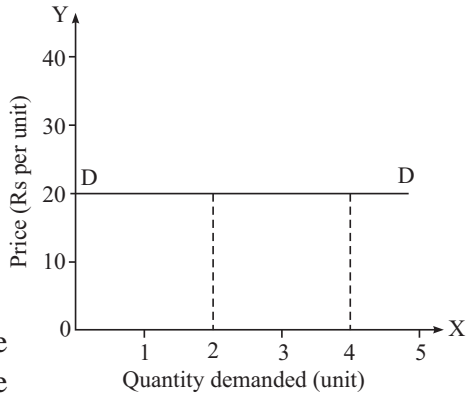


Fig. 16.5

INTEXT QUESTIONS 16.1

1. Define the following:
   (i) Price elasticity of demand
   (ii) Income elasticity of demand
   (iii) Cross elasticity of demand
2. When the demand for a commodity is called elastic?
3. What is the likely shape of the demand curve when the demand for a commodity is unitary elastic?

16.3 METHODS OF MEASUREMENT OF PRICE ELASTICITY OF DEMAND

There are following two methods of measurement of price elasticity of demand:

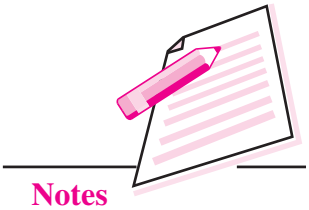
(i) Percentage change method

(ii) Geometric method

In addition to the above mentioned two methods, we will also explain the measurement of price elasticity of demand on the basis of change in total expenditure incurred on the commodity.

16.3.1 Percentage Change Method

This method is also called **'proportionate method'** or flux method. According to this method price elasticity of demand is measured as a ratio of percentage change



in quantity demanded to the percentage change in price of the commodity.

Price elasticity of demand (e_d)

$$= \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of the commodity}}$$

Percentage change in quantity demanded

$$= \frac{\text{Change in quantity } (\Delta Q)}{\text{Initial quantity } (Q)} \times 100$$

$$\text{Percentage change in price} = \frac{\text{Change in price } (\Delta P)}{\text{Initial price } (P)} \times 100$$

Therefore,
$$e_d = \frac{\frac{\Delta Q}{Q} \times 100}{\frac{\Delta P}{P} \times 100}$$

Where ΔQ = Change in quantity demanded

Q = Initial quantity demanded

ΔP = Change in price

P = Initial price

Illustration 1

Calculate price elasticity of demand if quantity demanded of a commodity rises by 20% due to 8% fall in its price.

Solution:

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of the commodity}}$$

$$= \frac{20}{(-)8} = (-)\ 2.5$$

[This is to be noted that price elasticity of demand is always a negative number because of inverse relationship between price and quantity demanded. However, minus sign is often ignored while writing the value of elasticity.]

Notes

Illustration 2

When price of a commodity is ₹ 10 per unit, its demand is 100 units. When the price falls to ₹ 8 per unit, demand expands to 150 units. Calculate price elasticity of demand.

Solution:

$$e_d = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of the commodity}}$$

$$\text{Percentage change in quantity demanded} = \frac{(150-100)}{100} \times 100 = 50\%$$

$$\text{Percentage change in price} = \frac{(-)2}{10} \times 100 = (-)20\%$$

So,
$$e_d = \frac{50}{(-)20} = (-)2.5$$

We can also use the simplified formula for percentage change method.

$$e_d = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

$$= \frac{150-100}{(8-10)} \times \frac{10}{100}$$

$$= \frac{50}{(-)2} \times \frac{10}{100}$$

$$= (-)\ 2.5$$

Illustration 3

Price elasticity of demand of a commodity is (–) 2. A consumer demands 50 units of this commodity when its price is ₹ 10 per unit. At what price he will demand 40 units of this commodity?

Solution:

$$e_d = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

$$\Rightarrow \quad (-)2 = \frac{40-50}{\Delta P} \times \frac{10}{50}$$

$$\Rightarrow \quad -2 = \frac{(-)10}{\Delta P} \times \frac{10}{50}$$

$$\Rightarrow \quad \Delta P = \text{Re } 1 \text{ per unit}$$

$$\text{New price} = 10 + 1$$

$$= ₹ \ 11 \text{ per unit}$$

16.3.2 Geometric Method

This method is also known as 'point method'. Geometric method is used to measure the elasticity at a point on the straight line demand curve. Elasticity of demand is different at different points on the same straight line demand curve.

According to the geometric method, elasticity of demand at any point of a straight line demand curve is measured as a ratio of lower segment of the demand curve and upper segment of the demand curve

$$e_d = \frac{\text{Lower segment of the demand curve}}{\text{Upper segment of the demand curve}}$$

Let us consider a straight line demand curve AB at which elasticity of demand is to be measured at point C, D, M, N, and P (Fig. 16.5).

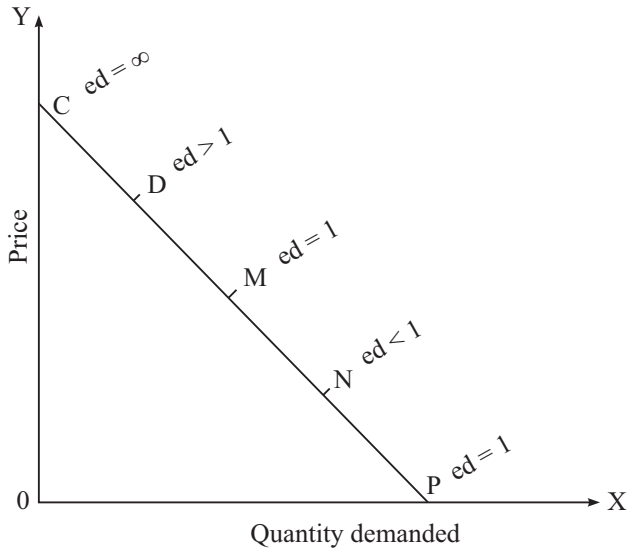


Fig. 16.6

M is the mid- point of the demand curve AB.

So, e_d at point M = $\frac{\text{Lower segment of the demand curve}}{\text{Upper segment of the demand curve}}$

$= \frac{MP}{MC} = 1$

(Because MP= MC)

e_d at point N = $\frac{NP}{NC}$

Point N is below point M so NP is less than NC and elasticity will be less than one.

e_d at point P = $\frac{0}{PC} = 0$

(Here lower segment is 0)

e_d at point D = $\frac{DP}{DC}$

Point D is above point M. So, DP is more than DC. Elasticity at this point will be more than one.

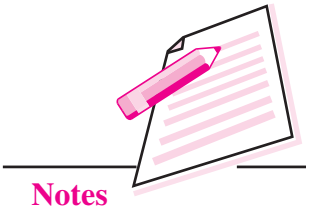
e_d at point C = $\frac{CP}{0} = \infty$

(Upper segment is 0)

So, we can conclude that elasticity at mid- point of a straight line demand curve will be 1, elasticity at every point below the mid- point will be less than one and elasticity at every point above the mid- point will be greater than one.

16.4 RELATIONSHIP BETWEEN TOTAL EXPENDITURE AND PRICE ELASTICITY OF DEMAND

We have studied that price of a good and its quantity demanded are inversely related. So, responsiveness of demand in relation to change in price i.e. price elasticity of demand determines the change in expenditure. We can consider the following cases:



(i) Elasticity is less than one (e_d <1): When the demand for a commodity is less than unit elastic, a fall in price leads to fall in total expenditure and a rise in price leads to rise in total expenditure on the commodity. (Price of the commodity and total expenditure move in same direction).See table 16.6.

Table 16.6

Price (₹ Per unit)	Quantity Demanded (In Units)	Total Expenditure (In ₹)
12	10	120
10	11	110
8	12	96

(ii) Elasticity is more than unit elastic (e_d >1): When the demand for a commodity is more than unit elastic, a fall in price leads to rise in total expenditure and a rise in price leads to a fall in total expenditure on the commodity. (Price of the commodity and total expenditure move in opposite direction).See table 16.7.

Table 16.7

Price (₹ Per unit)	Quantity Demanded (In Units)	Total Expenditure (In ₹)
12	10	120
10	14	140
8	20	160

(iii) Elasticity is equal to one (e_d = 1): When the demand for a commodity is unit elastic, total expenditure incurred on the commodity does not change with the change in its price. See table 16.8.

Table 16.8

Price (₹ Per unit)	Quantity Demanded (In Units)	Total Expenditure (In ₹)
12	10	120
10	12	120
8	15	120

All the three cases discussed above are shown diagrammatically in Fig. 16.7

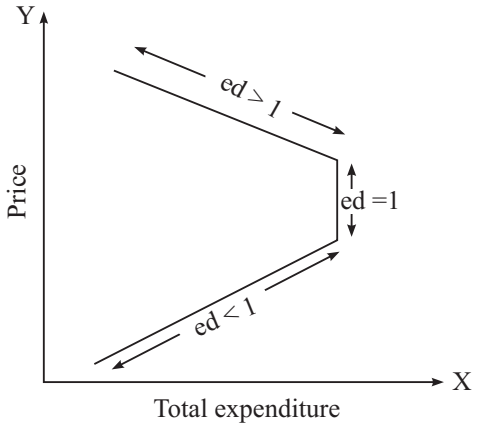


Fig. 16.7

Illustration 1:

Due to 2% fall in price of good X total expenditure on good X rises by 3%. A 10 % rise in price of good Y leads to 20 % rise in total expenditure on good Y. Using total expenditure method, compare price elasticity of demand of good X and good Y.

Solution:

Demand for good X is more than unit elastic because price of the commodity and total expenditure on the commodity move in opposite direction.

Demand for good Y is less than unit elastic because price of the commodity and total expenditure on the commodity move in same direction.

Illustration 2:

When the price of a good changes to ₹ 11 per unit, the consumer's demand falls from 11 units to 7 units. The price elasticity of demand is (–) 1. What was the price before change? Use expenditure approach of price elasticity of demand to answer this question.

Solution:

Price (₹ Per unit)	Quantity Demanded (In Units)	Total Expenditure (In ₹)
?	11	?
11	7	77

As the price elasticity of demand is (–) 1 i.e. unit elastic, so, total expenditure will remain unchanged at ₹ 77. Therefore, price before change was 77/11 = ₹ 7 per unit

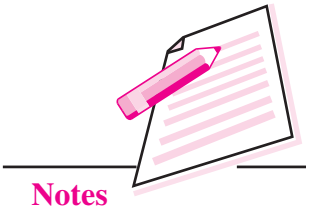


Illustration 3:

When price of a good falls from ₹ 10 per unit to ₹ 9 per unit, its demand rises from 9 units to 10 units. Compare expenditures on the good to find price elasticity of demand.

Price (₹ Per unit)	Quantity Demanded (In Units)	Total Expenditure (In ₹)
10	9	90
9	10	90

The demand for the good is unit elastic as the total expenditure remains unchanged at ₹ 90 when its price falls.

16.5 FACTORS AFFECTING PRICE ELASTICITY OF DEMAND

As discussed earlier, in case of some goods responsiveness of quantity demanded to the change in price is more than some other goods. For example, a very small change in price of luxury goods may affect their demand to a considerable extent but a large change in price of salt may not affect its demand. This means, price elasticity of demand is different for different goods. Following factors may affect the price elasticity of demand for a good:

(i) **Availability of close substitutes:** Demand for a commodity which has large number of substitutes, is usually more elastic than those commodities which have no substitutes. For example, coke, Pepsi, limca etc. are good substitutes. Even a small rise in price of coke will induce the buyers to go for its substitutes. On the other hand demand for electricity will be less elastic because it has no close substitutes.

(ii) **Nature of the Commodity:** Demand for necessities like medicines, food grains is less elastic because we have to consume them in minimum required quantity, whatever their price may be. But demand for comforts and luxuries like refrigerators, air conditioners etc. is more elastic because their consumption may be postponed for future if their price rises.

(iii) **Share in Total Expenditure:** Greater the proportion of income spent on the commodity, more is the elasticity of demand for it. Demand for a commodity is inelastic if proportion of income spent on that commodity is very small.

(iv) **Level of Price:** Demand for a commodity at higher level of price (like air conditioners, cars etc.) is generally more elastic than for a commodity at lower level of price (like match box, pencils etc.)

(v) **Level of Income:** Demand for a commodity is generally less elastic for higher income level groups in comparison to people with low incomes. For example,

if price of a good rises, a rich consumer is not likely to reduce his demand but a poor consumer can reduce his demand for that commodity.

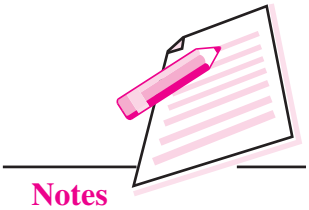
(vi) Habits: Habits of consumers also determine price elasticity of demand of commodities. For example, a chain smoker will not restrict his smoking even when the price of cigarettes rise.

INTEXT QUESTIONS 16.2

1. Due to 5% fall in price of a commodity its demand rises by 7.5%. Calculate and state coefficient of price elasticity of demand. Whether the demand is elastic or inelastic? Give reason.
2. Write formula for measuring price elasticity of demand at a point on a straight line demand curve.
3. The total expenditure on a commodity falls when its price rises. Comment on the price elasticity of demand of the commodity.
4. State any two factors which may affect price elasticity of demand of a commodity.
5. Why is the demand for water inelastic?

WHAT YOU HAVE LEARNT

- Price elasticity of demand is the degree of responsiveness of demand for a commodity to the change in its price.
- When quantity demanded of a commodity does not change at all in response to change in its price, the demand for the commodity is called perfectly inelastic.
- The demand for a commodity is called less than unit elastic when the percentage change in quantity demanded is less than the percentage change in its price.
- The demand for a commodity is called unit elastic when the percentage change in quantity demanded equals the percentage change in its price.
- The demand for a commodity will be more than unit elastic if the percentage change in quantity demanded is more than the percentage change in its price.
- When the demand for a commodity expands or contracts to any extent without or very little change in its price, its demand is called perfectly elastic.



- By percentage method, price elasticity of demand can be ascertained by the formula:

$$e_d = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price of the commodity}}$$

$$= \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

- Price elasticity of demand at mid- point of a straight line demand curve will be 1, elasticity at every point below the mid- point will be less than 1 and elasticity at every point above mid- point will be greater than 1.
- When the demand for a commodity is less than unit elastic, price of the commodity and total expenditure on the commodity move in same direction.
- When the demand for a commodity is more than unit elastic, price of the commodity and total expenditure on the commodity move in opposite direction.
- When the demand for a commodity is unit elastic, total expenditure incurred on the commodity does not change with the change in its price.
- Price elasticity of demand of a commodity is influenced by (i) availability of close substitutes, (ii) nature of the commodity, (iii) share in total expenditure, (iv) level of price, (v) level of income and, (vi) habits etc.

TERMINAL EXERCISE

1. Draw diagrams for:
   (i) Perfectly elastic demand
   (ii) Perfectly inelastic demand
   (iii) Unit elastic demand
2. Prepare a schedule for:
   (i) More than unit elastic demand
   (ii) Less than unit elastic demand
3. Explain 'percentage change' method of measuring price elasticity of demand.
4. Explain the relationship between total expenditure incurred on a commodity and its price elasticity of demand.
5. How is price elasticity of demand of a commodity affected by availability of its close substitutes? Explain.

6. A household purchases 40 units of a good when its price is Re. 1 per unit. At what price he would purchase 36 units of it if coefficient of price elasticity of demand is unitary.
7. What quantity of a commodity would a household purchase at a price of ₹ 12 per unit, if he purchases 40 units of it at ₹ 10 per unit? Price elasticity of demand is (-) 1.5.
8. A household spends ₹ 120 on purchase of a commodity when its price is ₹ 6 per unit. When price rises to ₹ 10 per unit, his total expenditure on this commodity becomes ₹ 180. Calculate price elasticity of demand by percentage change method.
9. When price of a commodity falls from ₹ 20 per unit to ₹ 16 per unit, its quantity demanded increases by 20%. Calculate coefficient of price elasticity of demand.
10. A consumer buys 15 units of a good at a price of ₹ 10 per unit. At price ₹ 15 per unit he buys 10 units. What is price elasticity of demand? Use expenditure approach. Comment on the likely shape of demand curve on the basis of this measure of elasticity.

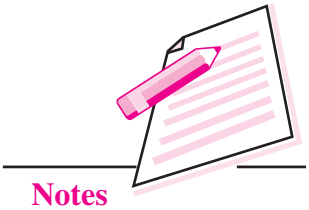
ANSWER TO INTEXT QUESTIONS

16.1

1. Read section 16.1
2. Read section 16.2(iv)
3. Rectangular hyperbola

16.2

1. e_d = 1.5, Demand is more than unit elastic because percentage change in quantity demanded is more than the percentage change in price of the commodity.
2. $e_d = \frac{\text{lower segment of demand curve}}{\text{Upper segment of demand curve}}$
3. Demand for the commodity is more than unit elastic because price and total expenditure move in opposite direction.
4. (i) Nature of the commodity (ii) Availability of close substitutes
5. Demand for water is inelastic because water is a necessity.



17

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PRODUCTION FUNCTION

When you go to the market to buy commodities such as note-books, fountain pens, shirts, bread, butter, fruits, vegetables etc. do you ever think about how these things came into the market. In previous lessons, you have studied about consumers, who constitute one part of the market and demand goods and services to satisfy their wants. Now, you will study the other part of the market - the producers or firms who produce goods and services for the satisfaction of consumers' wants. A producer or firm combines various factors inputs like land, labours, capital, entrepreneurship and other inputs like raw material, fuel etc. to produce goods and services that are demanded by the consumers. Man can neither produce a physical product nor can he distruct. Man can change only the form of a physical product. He can create utilities only. Thus production means creation or addition of utility. Any activity that makes a product more useful is collect production. In this lesson you will study about how these inputs are combined to produce goods and services.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning of production;
- define production function;
- understand the meaning of production function in the short run known as law of variable proportions;
- understand the different concepts of production and show their relationships;
- differentiate between fixed and variable factors of production or inputs; and
- explain the reasons of operation of the laws of production.

Notes

17.1 MEANING OF PRODUCTION

Production may be defined as a process through which a firm transforms inputs into output. It is the process of creating goods and services with the help of factors of production or inputs for satisfaction of human wants. In other words, 'transformation of inputs into output' whereby value is added, is broadly called production. Whatever is used in the production of a commodity is called input. For example, in the production of wheat, the use of land, seed, fertilizer water, pesticides, tractors, labour etc. are inputs and wheat is output. The relationship between inputs and output of a commodity depends upon the state of technology because with the help of advanced technology more can be produced with the help of same inputs or same output can be produced with the help of less inputs.

Before defining production function we should understand the following concepts related to production function:

(a) Short run and long run

Short run refers to a time period in which a firm does not have sufficient time to increase the scale of output. It can increase only the level of output by increasing the quantity of a variable factor and making intensive use of the existing fixed factors. On the other hand long run refers to the time period in which the firms can increase the scale of output by increasing the quantity of all the factor inputs simultaneously and in the same proportion.

The distinction between fixed and variable factors is relevant only in the short run but this distinction disappears in the long run.

(b) Fixed factors and variable factors

Fixed factors are those factors of production whose quantity can not be hanged with change in the level of output. For example, the quantity of land, machinery etc. can not be hanged during short run.

On the other hand, variable factors are those factors of production whose quantity can easily be hanged with change in the level of output. For example, we can easily change the quantity of labour to increase or decrease the production.

(c) Level of production and scale of production

When any firm increases production by increasing the quantity of one factor input where as the quantity of other factor inputs keeping constant; it increases the level of production. But on the other hand, when the firms increases production by increasing the quantity of all the factors of production simultaneously and in the same proportion, it increases the scale of production.

17.2 DEFINITION OF PRODUCTION FUNCTION

In economics, production function refers to the physical relationship between inputs and output under given technology. In otherwords production function is a mathematical functional/technical/engineering relationship between inputs and output such that with a given combination of factor inputs and technology at a given period of time, the maximum possible output can be produced. Such as land, labour capital and entrepreneurship.

If there are two factor inputs: labour (L) and capital (K), then production function can be written as:

$Q_x = f(L, K)$ where Q_x is the quantity of output of commodity x, f is the function and L and k are the units of labour and capital respectively. It says that quantity of output depends on units of labour on capital used in production.

Here two points are worth considering. Firstly, production function must be considered with reference to particular period of time i.e. short period and long period. Secondly, production function is determined by state of technology.

(i) Short run production function

A production function that shows the changes in output when only one factor is changed while other factor remains constant is termed as a short run production function. In the above example of production funciton, Labour (L) is considered as the variable factor which can be changed to influence the level of output. The other factor capital (K) is a fixed factor which can not be changed. The underlying theory to the short run production function is the "Law of variable proportion or Returns to a factor". This law will be discussed later in this chapter.

(ii) Long run production function

A long run production function studies the impact on output when all the factors of production can be changed simultaneously and in the same proportion. So in the long run size of operation of the firm can be expanded or contracted depending on the fact that the factors of production are increased or decreased. The underlying theory to the long run production function is the returns to scale which will be discussed later in this lesson:

INTEXT QUESTIONS 17.1

(i) What is meant by production?

(ii) Define a production function.

Notes

(iii) Distinguish between short-run production function and long-run production function.

Before studying the law of variable proportions we have to understand the three measures of production and their relationships because without understanding these measure of production, the concepts of laws of production can not be clearly understood.

There are mainly the following three measures of production:

(a) Total product or total physical product denoted by TPP.

(b) Average Product (AP) or Average physical produt denoted by APP.

(c) Marginal Product (MP) or marginal physical product denoted by MPP.

(a) Total Physical Product (TPP)

TPP is the total amount of a commodity that is produced with a given level of factor inputs and technology during a given period of time. For example, 2 units of labour combined with 2 units of capital can produce 26 fans per day. Here 26 fans is the total physical produt which is produced with the given level of inputs (labour and capital)

(b) Average Physical Produt (APP)

APP is the output produced per unit of input employed. It can be obtained by dividing TPP by the number of units of variable input. So APP = TPP/L where L is the units of labour. For example, if 10 workers make 30 chairs per day, the APP of a worker per day will be 30 ÷ 10 = 3 chairs. If the productivity of a factor increases, it implies that the output per unit of input has increased.

(c) Marginal Physical Product (MPP)

MPP of an input is the additional output that can be produced by employing one more unit of that input while keeping other inputs constant. For example, if ten tailors can make 50 shirts per day and 11 tailors can make 54 shirts per day, the marginal product of 11 workers will be 54 - 50 = 4 shirts per day.

We can further clarify the above three concepts of production with the help of the following table 17.1.

Table showing TPP, APP and HPP of fans per day in short run.

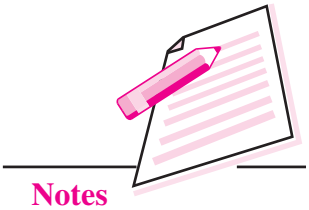


Table 17.1

Fixed factor (Capital units)	Variable factor (Labour units)	TPP (units)	APP (units)	MPP (units)
(1)	(2)	(3)	(4)	(5)
2	1	10	10	10
2	2	26	13	16
2	3	48	16	22
2	4	68	17	20
2	5	85	17	17
2	6	96	16	11
2	7	98	14	2
2	8	98	12.25	0
2	9	90	10	-8

The above table shows values of TPP, APP and MPP for different units of variable factor. For example, if we know the TPP of all the units of variable factor we an calculate APP by dividing TPP by the number of units of a variable factor. So APP = TPP/units of variable factor. For example in table 17.1 the TPP of 2 units of labour is 26, the APP will be 26 ÷ 2 = 13. In the same way we an calculate APP of all the units of a variable factor. We calculate MPP of 2 units labour by deducing TPP of 1 unit. From the TPP of 2 units labour i.e. 26 – 10 = 16 units. So MPPn = TPPn – TPPn – 1. If we know APP of all the units of a variable input we can calculate TPP by multiplying APP by the units of variable factor. In the above table APP of 4 units of labour is 17. TPP will be 17 × 4 = 68 units. In the source way we an calculate TPP of all other units of variable factor. So TPP = APP × L where L is the units of labour. If we know MPP of all the units of a variable we an calculate TPP by summing up the MPP of all the units of variable factor. For example, in table 17.1 the MPP of 1, 2, 3 and 4 units of labour are 10, 16, 22 and 22 and 20 respectively, the TPP of 4 units of labour can be derived by summing up the MPP of these 4 units of labour i.e. 10 + 16 + 22 + 20 = 68 units. TPP of all other units can be calculated in the same manner. Remember that for the 1 unit of labour TPP, APP and MPP are equal. So we can give the following formulas to calculate TPP, APP and MPP.

TPP = ΣMPP (Sum of MPP of all the units of a variable factor)

or $TPP = MPP_1 + MPP_2 + MPP_3 + ... MPP_n$

or TPP = APP × L where L indicates units of labour

$$APP = \frac{TPP}{L}$$ where L indicates units of labour

Notes

$MPP = \frac{\Delta TPP}{\Delta L}$ where ΔTPP is change in TPP and ΔL is change in units of labour

or $MPP_n = TPP_n - TPPn - 1$ for example, MPP of 2 units = TPP of 2 units – TPP of 1 units of labour

17.4 RELATIONSHIP BETWEEN TPP AND MPP

The relationship between TPP and MPP can be explained as given below:

(i) As long as MPP increases, TPP increases at an increasing rate.

(ii) When MPP falls but remains positive, TPP increases but at a diminishing rate.

(iii) When MPP becomes zero, TPP is maximum.

(iv) If MPP becomes negative, TPP starts decreasing.

17.5 RELATIONSHIP BETWEEN APP AND MPP

(i) As long as MPP is greater than APP, APP increases.

(ii) When MPP is equal to APP, APP is maximum and constant.

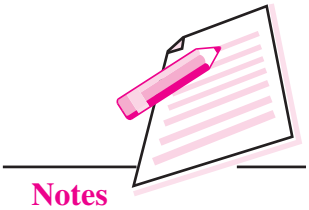
(iii) When MPP is less then APP, APP decreases.

(iv) MPP can be zero and negative but APP is never zero or negative.

The relationship among TPP, APP and MPP can also be explained with the help of the following table. 17.2

Table 17.2: Hypothetical schedule of TPP, APP and MPP

Land (Fixed factor)	Units of variable Factor (labour)	TPP (Units)	APP Units) (TPP/L)	MPP (Units) (ΔTPP/ΔL)
1 Acre	0	0	–	–
1 Acre	1	2	2	2
1 Acre	2	6	3	4
1 Acre	3	12	4	6
1 Acre	4	20	5	8
1 Acre	5	25	5	5
1 Acre	6	29	4.8	4
1 Acre	7	31	4.4	2
1 Acre	8	31	3.9	0
1 Acre	9	29	3.2	–2



In the above table 17.2 MPP is increasing upto 4 units of labour and TPP is increasing at an increasing rate. MPP is decreasing but remains positive from 5th to 8th unit of labour so TPP is increasing at a diminishing rate. For 8th unit of labour MPP is zero where TPP is maximum. But for 9th unit of labour MPP becomes negative so TPP also starts decreasing.

In the same way upto 4 units of labour MPP is greater than APP, so APP is increasing. At 5th units of labour MP = APP so APP is maximum and constant. At 6th units of labour MPP is less than APP, So APP is decreasing.

Relationship among TPP, APP and MPP (through diagram)

To understand the relationship among TPP, APP and MPP, let us considers the following diagram.

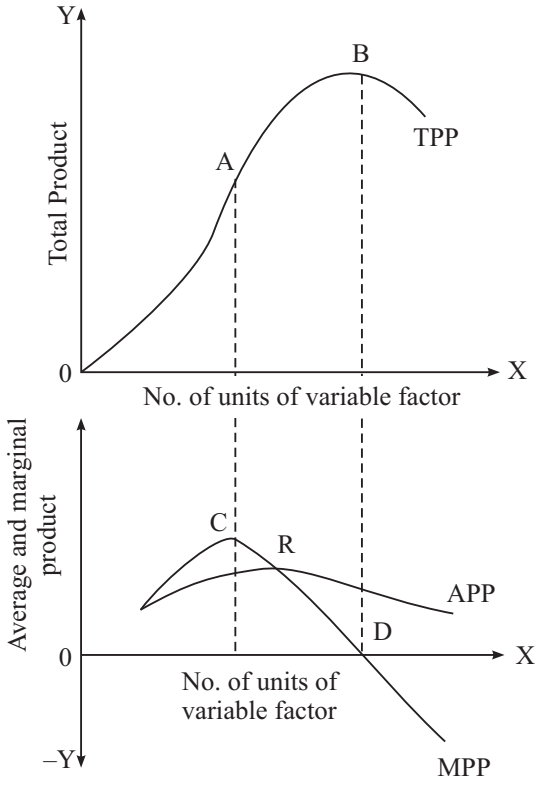


Fig. 17.1

In the above figure 17.1 TPP increases from point O to pint B. There are two phases of this increase in TPP. First, from O to A in which TPP increases at on increasing rate. In this phase in the lower portion of the diagram MPP increases upto point

C. So we can conclude that when MPP increases TPP increases at an increasing rate. Second phase of increase in TPP is from A to B in which TPP increases at a diminishing rate. In the lower portion of the diagram, MPP decreases from point C to point D but it remain positive. So we can conclude that when MPP falls but remains positive, TPP increases at a diminishing rate. At point B on TPP curve, TPP is maximum. In the lower portion of the diagram MPP is zero at point D. So we conclude that where MPP is zero, TPP is maximum. After point B, TPP falls. After point D MPP becomes negative and TPP falls.

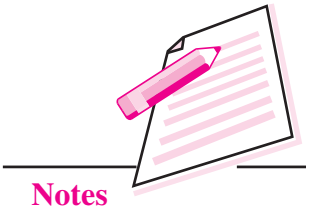
In the lower portion of the above figure 17.1, APP and MPP curves have been drawn. Before point R on APP curve, MPP is greater than APP, so APP increases. At point R MPP is equal to APP. At this point. APP is constant and maximum. After point R on APP curve, MPP curve is below APP curve, so we can say that when MPP is less than APP, APP falls.

INTEXT QUESTIONS 17.2

1. What are primary inputs? Give example.
2. What are secondary inputs? Give example.
3. Define variable factors of production.
4. What are fixed factors of productions? Explain with example.
5. Distinguish between fixed and variable factors of production.
6. Can total product ever decline? If yes, when?
7. What happens to TPP when MPP is zero?
8. What happens to TPP when MPP increases?
9. Explain the relationship between TPP and MPP.
10. What is the relationship between APP and MPP?

17.6 LAW OF VARIABLE PROPORTIONS

The law of variable proportions is a short period production law. It is also called returns to a factor. Let us first understand the meaning of variable proportions. In a production process when only one factor is varied and all other factors remain constant, as more and more units of variable factor are employed, the proportion between fixed and variable factors goes on changing. So it is termed as the law of variable proportions. This law states that if you go on using more and more units of variable factor (labour) with fixed factor (capital), the total output initially



increases at an increasing rate but beyond a certain point, it increases at a diminishing rate and finally it falls. This law was initially called the law of dimiting returns Marshall who applied the law only in agriculture sector but modern economist called it the law of variable proprotion and proposed its applicability to all the sectors of the economy.

Assumption of the law

The law operates under the following assumptions:

(i) The firm operates in the short run.

(ii) There is no change in technology of production.

(iii) The production process allows the different factor ratios to produce different levels out output.

(iv) All the units of variable factor are equally efficient.

(v) Full substitutability of factors of production is not possible.

According to the law when we employ more and more units of a variable factor with the fixed quantity of other factors and technology, the marginal product of the variable factor first increases and then decreases. In other words, with employment of more and more units of a variable factor with fixed quantity of other factors, the total product first increases and then starts decreasing. It means that in short run labour is the only variable factor, Return to labour or marginal product of labour initially increases but as more units of labour are employed its MPP declines and may also become negative. There are three phases of returns to a variable factor which are discussed below.

(a) Phase I: Increasing Returns to a factor

In this phase TPP increases at an increasing rate and marginal product of variable factor, labour increases. In the end of this phase MPP is maximum. So, this is the phase of increasing returns to a factor.

(b) Phase II: Diminishing Returns to a factor

In this phase TPP increases but at a diminishing rate MPP declines but remains positive. At the end of this phase MPP is zero. At this point TPP is maximums. So, this is the phase of diminishing returns to a factor.

(c) Phase III: Negative Returns to a factor

In this phase, MPP declines and it becomes negative. Here the TPP also starts falling. It operates from the level of output where MPP of labour is zero but subsequently becomes negative. The table 17.2 given below illustrates the three phases of the law of variable proportions.

Table 17.2: Low of variable proportions

Units of land (Fixed input)	Units of labour (variable input)	TPP (units)	MPP (units)	Phases
1	1	3	3	TPP increase at an increasing rate
1	2	7	4	→ MPP is increasing (Phase I)
1	3	12	5	
1	4	16	4	TPP increases at a diminishing rate
1	5	19	3	and MPP falls but remains
1	6	21	2	→ positive (Phase II)
1	7	22	1	
1	8	22	0	
1	9	21	–1	TPP falls and MPP becomes
1	10	20	–2	→ negative (Phase III)

This law can also be explained with the help of figure given below.

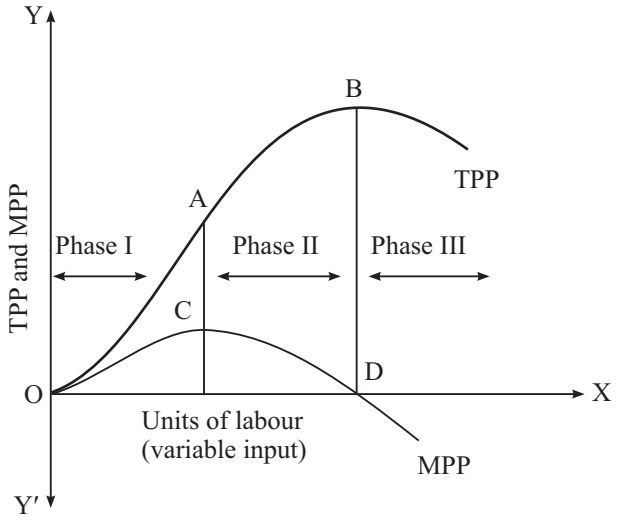


Fig. 17.2

The figure 17.2 given above shows that TPP increases from 0 to B but there are two parts of this increase. First is from 0 to A in which TPP increases at an increasing rate. This is in the I phase of the law. In this phase MPP increases from 0 to C.

In the second part from A to B TPP increases at a diminishing rate. This is in the II phase of the law. In this phase MPP decreases from point C to point D. At point D MPP is zero. TPP is maximum at point B.

After point B TPP starts falling. This is in III phase of the law. In this phase MPP becomes negative after point D.

17.7 REASONS BEHIND DIFFERENT PHASES OF THE LAW OF VARIABLE PROPORTIONS

In phase I, we get increasing returns to a variable input because greater use of variable inputs makes it possible to utilize fixed indivisible factor more efficiently and also to introduce a greater division of labour and specialization. It leads to optimum combination of fixed and variable inputs.

In phase II, we get diminishing returns to a variable input because in this stage the proportion between variable and fixed inputs has crossed the optimum proportion between them and a variable input such as labour has less and less fixed input to work with.

In phase III, the variable input becomes too much relative to fixed inputs which obstructs the production process and therefore results in fall of TPP. because MPP becomes negative. So, phase III is called the stage of negative returns to variable factor. So phase III is called the stage of negative returns to variable factor.

17.8 LAW OF DIMINISHING MARGINAL PRODUCT

The law of variable proportions is an extension of the law of diminishing returns to a factor. The law of diminishing returns to a factor states that as more and more units of a variable factor are employed with fixed factors and technology, its marginal product eventually declines. The difference between this law and the law of variable proportions is that the former does not take into account increasing returns to a factor. According to the law of diminishing returns to a factor, the firm can operate only in phase II and III of the law of variable proportions. Hence the law of diminishing returns to a factor is a part of more general law of variable proportions. In figure 17.2, the law of diminishing returns to a factor operates after point A on TPP curve and point C on MPP curve.

Early economists believed that the diminishing returns to a factor sets in only in agriculture as land was fixed. It did not apply in industry as this sector continuously underwent technical upgradation. However, industry can postpone setting in of diminishing returns with technical advances. If technical advancements do not take place there is no increase in the efficiency of the factor inputs, then diminishing returns shall be applicable even in industry. According to modern economists, diminishing returns under the law of variable proportions are universally applicable to both the agriculture and industrial sectors.

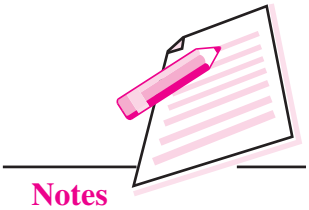
WHAT YOU HAVE LEARNT

- Production is the process of converting inputs into output.
- A production function shows the technical relationship between inputs and output.
- Fixed factors are those whose quantity does not change with change in output.
- Variable factors are those whose quantity changes with change in output.
- TPP is defined as the total output that is produced in a given time with given inputs and technology.
- APP is the output per unit of input.
- MPP is the addition to TPP by the employment of on additional unit of input.
- Relationship between TPP and MPP
  - (i) When MPP increases, TPP increases at an increasing rate.
  - (ii) When MPP decreases but remains positive, TPP increases at a diminishing rate.
  - (iii) When MPP is zero, TPP is maximum.
  - (iv) When MPP become negative, TPP starts decreasing.
- Relationship between TPP and MPP:
  - (i) As long as MPP is greater than TPP, APP increases.
  - (ii) When MPP is equal to APP, APP is constant and maximum.
  - (iii) When MPP is less than APP. APP decreases.
- The law of variable proportion states that as the additional units of a variable factor are combined with a given level of fixed factors and technology, the MPP of the varible factor first increases and then declines.
- There are three phases of the law of variable proportions:
  - (i) In phase I, increasing returns to a factor occur return MPP is increasing and TPP increases at an increasing rate:
  - (ii) In phase II, diminishing returns to a factor occur, taken MPP is declining but remain positive and TPP increase at a diminishing rate.

    In phase III, negative returns to a factor occur when MPP is negative and TPP starts fallowing.

TERMINAL EXERCISE

1. Define production
2. Define production function
3. Distinguishes between short period and long period production functions.



4. What is meant by IPP?
5. Define APP.
6. Define MPP.
7. Explain the relationship between TPP and MPP.
8. Explain the relationship between APP and MPP.
9. Explain the law of variable proportions with the help of a schedule and a diagram.
10. What are the reasons of the operation of law of variable proportions?
11. What are general shapes of APP and MPP?
12. Distinguish, between fixed factors and variable factors.

ANSWERS IS INTEXT QUESTIONS

17.1

(i) Reads section 17.1

(ii) Reads section 17.2

(iii) Read sections 17.2 (i) and (ii) Basic concepts

17.2

(i) Read section 17.3 (i) (Primary inputs)

(ii) Read section 17.3 (ii) (Secondary inputs)

(iii) Read section 17.3 (i) Variable inputs)

(iv) Read section 17.3 (ii) Fixed inputs)

(v) Read section 17.3

(vi) Read section 17.4

(vii) Read section 17.4

(viii) Read section 17.4

(ix) Read section 17.4

(x) Read section 17.5

Notes

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18

COST OF PRODUCTION

Cost analysis is the life line of modern business. It cannot be ignored at any cost for the success of any business organisation. On anlysis of cost is required. A producer can supply/produce the product by organising the factors of produciton. That means the producer has to hire or purchase land, labour, capital, etc. by paying price. So, to produce the product the firm or producer must incur some expenditure and the expenditure so involved is called cost of production. This lesson is aimed at discussing this aspect of production called cost of production.

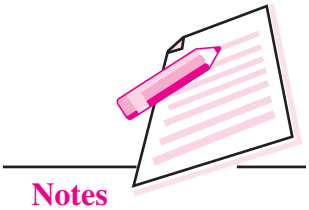
OBJECTIVES

After completing this lesson, you will be able to:

- define cost of production;
- distinguish between the meaning of cost as used in business and as used in economics;
- explain the meaning and importance of various concepts of cost such as, explicit cost, implicit cost and normal profit, fixed costs and variable costs; and
- find out total fixed cost, total variable cost, average fixed cost, average variable cost, average total cost and marginal cost.

18.1 DEFINITION OF COST AND COST FUNCTION

Cost is defined as the expenditure incurred by a firm or producer to purchase or hire factors of production in order to produce a product. As you know, factors of production are land, labour, capital and entrepreneurship. In the production process, the entrepreneur organises land, labour, capital and raw materials to produce output. As a producer he/she has to pay rent for land, wages to labour and interest to procure capital. The producer must also be compensated for his/her



services which is called normal profit. Wages, rent, interest, profit are called factor costs of production. Besides these, the producer also incurs expenditure on raw materials, electricity, water, depreciation of capital goods such as machines and indirect taxes etc. The producer also uses the services of certain factors supplied by his/her own self. The imputed value of such inputs also form the part of cost.

Cost Function

Since the producer who produces output incurs cost, we can say that cost is a function of output. It means that cost of production will increase or decrease, depends on whether level output is increasing or decreasing.

In the lesson on production, you have studied that output depends on factors of production such as labour, capital. Hence cost is related to expenditure on these factors. If the producer hires more amount of factors, cost will automatically increase and vice versa.

18.2 TYPES OF COST

(a) Explicit Costs (Money Costs)

A firm purchases the services of assets like building, machine etc. It pays hiring charges for building, normally termed as rent. It employs workers, accountant manager etc. and pays wages and salaries to them. It borrows money and pays interest on it. It purchases raw material, pays electricity bills and makes such other payments. All such actual payments, on purchasing and hiring different goods and services used in production are called **'explicit costs'.**

Normally, in business, the accountant takes into account only the actual money expenditure as cost. So in business the cost is normally the '**explicit cost'** only.

(b) Implicit costs (Imputed costs) :

Many a times, we find that all inputs are not always bought or hired by the producer from the market. Some of the inputs are provided by the entrepreneur or producer himself. He may use his own building. He may invest his own money in the business. He may be the manager of his own firm. A farmer may cultivate his own land. If a producer had taken a building from another production unit, he would have paid rent. In the same way, if he had borrowed money he would have paid a certain amount of interest. Similarly, if he had engaged a manager he would have paid him a salary. But he is not paying these amounts explicitely i.e. (rent for his building, interest on his money and salary for his services) because he has contributed them for his own business. So market value of these self-owned and self supplied inputs must be calculated. It is, therefore, a cost to the producer. We can make an estimate

of these costs on the basis of their prevailing market prices. Let us term such costs as **'implicit costs'** (to distinguish them from explicit costs). These are also termed as imputed costs. One example of such cost is the imputed rent of the self owned factory building. It can be taken as equivalent to the actual rent paid for a similar type of building. Similarly, we can find out imputed interest and imputed wages.

In microeconomics, in addition to the paid out cost, imputed cost is also included in the cost of production.

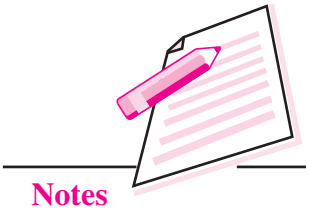
Opportunity cost

Economists define opportunity cost as the value of next best alternative foregone. What does this mean? It is a common practicve that a person makes a list of several activities before adopting a particular one to persue his/her goal. Similarly, in production a producer leaves some alternatives before finally choosing to produce the particular output. So, while finally choosing one, the producer did forego the alternative production. Let us take example of a farmer. He can produce either rice or wheat on a piece of land. If he has decided to produce wheat on this piece of land, he has to forego the produciton of rice for producing wheat. So, value of rice foregone (next best alternative) is the opportunity cost of producing wheat.

18.3 NORMAL PROFIT AS COST OF PRODUCTION

Another component of cost is **'normal profit'.** Normal profit is an additional amount over the monetary and imputed cost that must be received by an entrepreneur to induce him to produce the given product. Normal profit is entrepreneur's opportunity cost and therefore enters into cost of production. Opportunity cost is the value of the opportunity or alternative that is sacrificed. You may be wondering how is it that profit is an element of cost. We will try to convince you.

For that let us first understand the meaning of the term **'normal profit'.** It is nothing but the minimum assured profit in the next best occupation. Normal profit is the reward which an entrepreneur must receive for the risk and uncertainties he bears in the production of a commodity. It can be understood with an example. Suppose there is a publisher who has the option of publishing commerce books or science books. He chooses to publish commerce books because he gets higher return from these. Now, suppose, that the market for science books is more assured but profit is lower. This would mean that the publisher who is publishing commerce books is sacrificing an assured return on science books and is taking a risk. He would be prepared to face the risk only when he thinks that he would be able to get at least the same profit which he would have in any way got from science books. Loss of assured return on science books is then an element of cost for the



publisher who is publishing commerce books instead of science books. It is termed as **'normal profit'** because it is an estimate of the minimum expectations of a producer from a business. So long as he gets this minimum, he will continue to publish commerce books. If, at any stage, he does not get this amount, he will shift to the publication of science books. So, in order that a producer continues to produce a commodity he must get normal profit in addition to recovering his **'explicit cost'** and **'implicit cost'.** We hope you are now convinced that minimum expectation of a producer from a business is also an element of cost.

There are three elements of the total cost of production in micro economics

(a) Explicit costs

(b) Implicit costs and

(c) Normal profits.

In business accounts only explicit costs are treated as cost.

Let us consider an example of the total cost elements for a farmer, He requires following inputs to produce say rice; a piece of land; agricultural workers; tools and implements; tractor and harvester; water, seeds, manures, power, and many other things. He will either provide these inputs himself or he will purchase them from the market. Suppose; some of these inputs he provides himself and some of these he purchases from the market (see the following chart).

Chart Showing the Cost Elements for a Farmer

Total Cost of Production (Rice)

Explicit cost	Cost of self provided inputs or (implicit cost)	Normal Profit
1. Fertilizers	1. His own land	The minimum remuneration which must be earned by the farmer in order to induce him to produce this crop instead of switching over to the production of any other product
2. Insecticides	2. His own well, the water of which he uses for irrigation	
3. Wages for agricultural workers who are employed for sowing and harvesting.	3. His own seeds saved from last crops	
4. Rent for tractor and harvestor	4. His and his family members' labour	
5. Payments of electricity used for pump set, tube-well etc.		

INTEXT QUESTIONS 18.1

1. Fill in the blanks using appropriate word from the choice given in brackets:
   (i) Paid out cost is ..... (explicit cost, implicit cost).
   (ii) Normal profit ..... a part of cost of production in micro economics (is, is not).
2. Some of the cost elements of a publisher are given below. Allocate them into explicit cost and implicit cost : (i) his own labour (ii) expenditure on papers, ink, electricity etc. (iii) expenditure on printing machine (iv) insurance premium (v) payments of wages and salaries to workers (vi) his own building where he prints the books and (vii) expenditure on transport to bring raw material like papers, ink etc.

18.4 PRIVATE AND SOCIAL COSTS

(a) Private Costs

While producing a commodity a firm has to pay for raw material; it has to pay wages of workers; it has to pay rent of building. These are private costs for the firms. Thus private costs are the expenditure of an individual firm in producing a commodity.

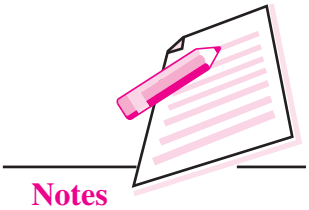
(b) Social Costs

Factories emit large amount of smoke from their chimneys into the atmosphere. This may not figure in the calculation of costs in their records. But the cost to the community may be in the form of additional washing bills for clothes and the money spent by the community on medical bills etc. These costs are social costs.

18.5 MONEY COST VS REAL COST

The explicit cost and the private cost referred above are actually incurred by the producer in money terms. So, they are also called money cost. Wage to labour, rent for building, interest on borrowed funds etc. are paid in monetary units and hence called money cost.

Real cost, on the otherhand, has no definite money value nor it can be measured in monetary terms. A producer makes a lots of sacrifices and toils hard to set up business. The pain, discomfort, stress and strain that he/she undergoes cannot be measured in money. This is called real cost to the producer. The sacrifice, discomfort, disutility, toils and efforts involved in supplying factors of production by their owners make real cost of production.



18.6 NATURE OF COST IN PRODUCTION PROCESS

You have already studied that production process, in the short run, involves fixed and variable factors whereas in the long run all factors are variable. Accordingly, cost of production is calculated depending on whether production is taking place in short run or in the long run.

Cost in the short run: Fixed vs variable cost : In the short run two types of factors are identified. One, fixed factors which cannot be changed and two, variable factors which can be changed to increase output. Fixed costs are those costs which do not change with any changes in the quantity of production or size of output during period. They remain constant during the whole period at any level of output. Whether the production is zero or less or more. Then cost are fixed in nature. Fixed costs are also known as supplementary cost. Let the rent of a factory building paid by the producer is ₹ 1000 per month. Whether the producer produces the output or not, he/she has to pay the rent after hiring the building.

On the other hand variable cost are those cost which vary with the change in the quantity of output or production. They do not remain constant and are variable in nature. There cost increase with increase in output and decrease with a decrease in output. These costs are related to variable factor of production. They are also known as direct cost or prime cost. For example, labour is called variable factor in the short run. So, wage paid to labour is a variable cost. In order to increase output, producer can hire more units of labour. So, the expenditure on wages will increase. If output level is to be reduced, then producer can reduce the amount of labour and accordingly less amount of wage will be paid. So variable cost varies with change in level of output.

18.7 CALCULATION OF FIXED AND VARIABLE COST

TFC Total expenditure on fixed factors is called total fixed cost (TFC)

TVC Total expenditure on variable factors is called total variable cost (TVC)

TC Sum of TFC and TVC is the total cost (TC)

TC = TFC + TVC

(c) Illustration

The concepts of fixed costs and variable costs can be understood better with the help of a schedule and an illustration. Suppose, a firm producing pens incurs the following costs at different levels of output (as given in Table 18.1): You will see that its fixed cost remains constant whereas variable cost changes with every change in level of output. In this schedule, the fixed cost is ₹ 60 and remains the

same at all levels of output. The variable cost is ₹ 60 when the producer is producing 100 pens. It rises to ₹ 100 when he produces 200 pens and to ₹ 150 when he produces 300 pens and so on.

Table 18.1 : Cost Schedule of a Firm

No. of pens in units (1 unit = 100 pens)	Total fixed cost (₹)	Total variable cost (₹)
0	60	0
1	60	60
2	60	100
3	60	150
4	60	260
5	60	390

INTEXT QUESTIONS 18.2

State whether the following statements are true or false:

(i) With increase in the quantity of output fixed costs increase.

(ii) There are no variable costs at zero output

(iii) Expenses incurred on watchmen and property tax are fixed cost.

(iv) Variable costs change with every change in output.

(v) Cost incurred on all the labour is variable.

18.8 CALCULATION OF COST

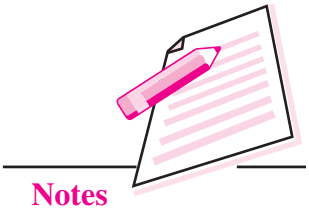
Total cost of a given volume of output is the sum of the explicit and implicit costs and normal profit. In the previous section we have learnt that production costs are classified into fixed cost and variable cost.

These two costs together make total cost

i.e., $TC = TFC + TVC$

where TC stands for total cost, TFC for total fixed cost and TVC for total variable cost.

When a production unit is established but there is no production, total cost is the same as the total fixed cost. As production takes place, variable cost is also incurred and so total cost changes. Total cost increases as the quantity of output



rises, The change in total cost equals the change in total variable cost. This is because total fixed cost remains constant at all quantities of output. Change in total cost is due to changes in variable cost only. The calculation of total cost can be explained through the following example :

Table 18.2 : Cost Schedule of a Pen Producer

No. of pens in units (one unit = 100 pens)	TFC (₹)	TVC (₹)	TC (TFC+TVC) (₹)
0	60	0	60
1	60	60	120
2	60	100	160
3	60	150	210
4	60	260	320
5	60 .	390	450

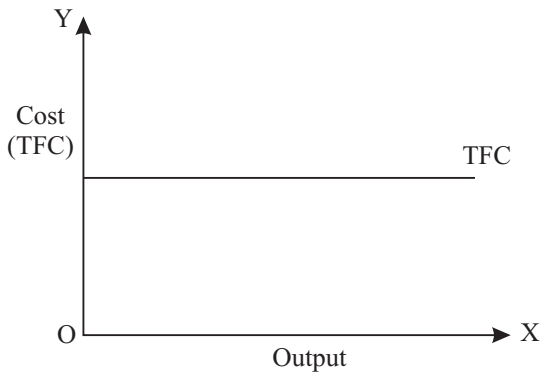


Fig. 18.1

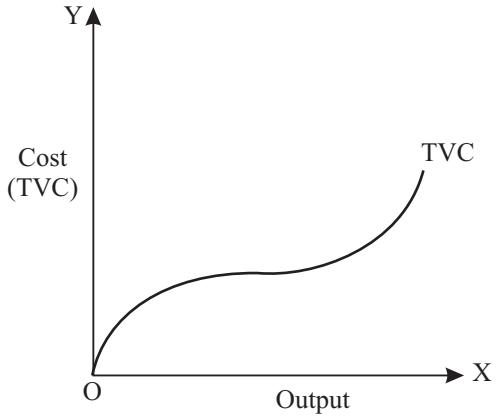


Fig. 18.2

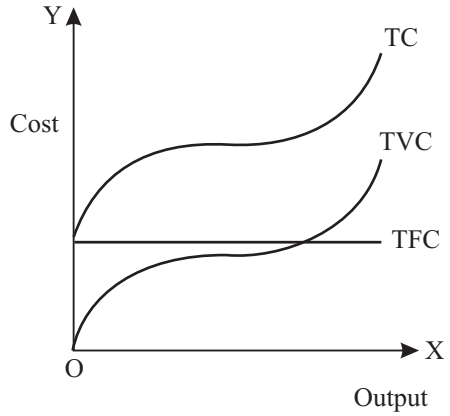


Fig. 18.3

The Table 18.2 shows that total fixed cost is ₹ 60 and remains the same at all quantities of output. The variable cost equals ₹ 60 when one unit is produced, increases to ₹ 100 at 2 units and to ₹ 150 at 3 units and so on. As the total cost is the sum of total fixed cost and total variable cost, it can be obtained by adding them at various quantities of output. For example, when one unit is produced total cost is ₹ 120 (₹ 60 + ₹ 60) and when two units are produced, it works out to be ₹ 160 (₹ 60 + ₹ 100). Thus, we find that total cost varies directly with the level of output.

INTEXT QUESTIONS 18.3

Fill ill the blanks with appropriate words given in the brackets:

(i) Changes in total cost when output varies are due to changes in ..... (fixed cost, variable cost).

(ii) To find total cost we have to ..... total fixed cost and total variable cost (add, multiply)

(iii) Total cost ..... zero at zero output (is, is not).

(iv) When output is zero total cost equals .....(fixed cost, variable cost).

18.9 AVERAGE COST

In this section, we will discuss the concepts of average fixed cost (AFC), average variable cost (AVC) and average total cost (ATC). We make the following schedule showing calculations of these costs:

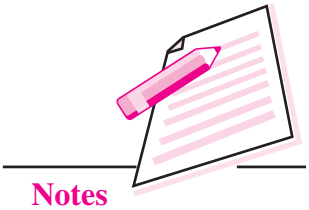


Table 18.3 : Cost Schedule of a Pen Producer

Output of pens(1 unit = 100 pens)	TFC (₹)	TVC (₹)	TC (TFC+TVC) (₹)	AFC ₹	AVC ₹	ATC (AFC+AVC) (₹)
0	60	0	60	-	-	-
1	60	60	120	60	60	120
2	60	100	160	30	50	80
3	60	150.	210	20	50	70
4	60	260	320	15	65	80
5	60	390	450	12	78	90

(a) Average Fixed Cost (AFC) :

Average fixed cost is obtained by dividing total fixed cost by the number of units of output produced.

$$AFC = \frac{TFC}{\text{Units of output}}$$

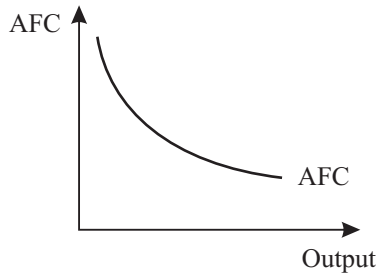


Fig. 18.4

Thus, Average Fixed Cost is per unit fixed cost in producing a commodity or fixed cost per unit of output.

Fixed cost by definition remains fixed whatever is the level of output. Therefore, as production expands the total fixed cost is distributed over a larger numbers of units. As a result average fixed cost falls with every increase in output. For example, the total fixed cost of our producer is ₹ 60 when he produces one unit. Average fixed cost is ₹ 60 (₹ 60 ÷ 1) But if the production is increased to 2 units, average fixed cost is ₹ 30 (₹ 60 ÷ 2). When he produces 3 units it is ₹ 20 (₹ 60 ÷ 3). Therefore, the larger the output the lower will be the average fixed cost.

(b) Average Variable Cost (AVC)

Average variable cost is obtained by dividing the total variable cost by the units of output produced.

$$AVC = \frac{TVC}{\text{Units of output}}$$

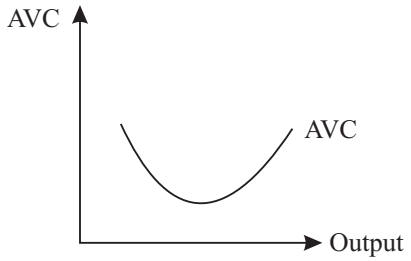


Fig. 18.5

Thus, average variable cost is per unit variable cost in producing a commodity or variable cost per unit of output.

When output of pens is one unit TVC is ₹ 60, so AVC will be ₹ 60 (₹ 60 ÷ 1). TVC at 2 units of pens is ₹ 100. So AVC at 2 units of output of pens is ₹ 50 (₹ 100 ÷ 2) and so on.

(c) Average Total Cost (ATC) :

ATC is obtained by dividing the Total Cost (TC) by the total units of output:

$$ATC = \frac{TC}{\text{Units of output}}$$

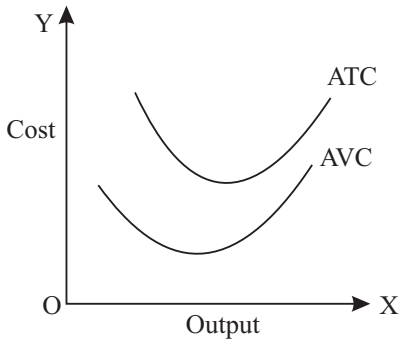
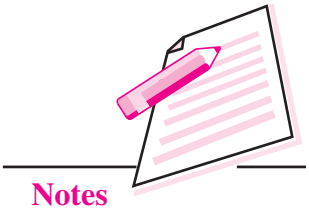


Fig. 18.6

Thus, total cost is the per unit total cost in producing a commodity or cost per unit of output.

The total cost of producing one unit of pen is ₹ 120. Therefore, ATC is ₹ 120 (₹ 120 ÷ 1).

Total cost of 2 units of output is ₹ 160. So ATC is ₹ 80 (₹ 160 ÷ 2). As total cost is the sum of TFC and TVC, average total cost is the sum of AFC and AVC. So we can also find out ATC by adding AFC and AVC :



ATC = AFC + AVC

$$\frac{TC}{\text{Units of output}} = \frac{TFC}{\text{Units of output}} + \frac{TVC}{\text{Units of output}}$$

Check up from the schedule that ATC can also be calculated in this manner.

INTEXT QUESTIONS 18.4

Fill in the blanks with appropriate words given in the brackets:

(i) Average cost is ..... (cost per unit, cost incurred on additional unit).

(ii) To find total cost we have to ..... average cost by quantity of output (multiply, divide).

(iii) Average fixed cost ..... with the increase in output (falls, rises).

(iv) Average total cost is the sum of ..... and .....

(average fixed cost, average variable cost, variable cost, fixed cost).

18.10 MARGINAL COST

The concept of marginal cost is a very important concept in micro economics. The importance of this concept will be more clear to you when you read lesson No. 20 on 'Maximisation of Profits'. The word marginal should be taken to mean additional. For example, Marginal cost of producing a level of output is the addition to the total cost or total variable cost caused by producing an extra unit of output.

$$MC_N = TC_N - TC_{N-1}$$

or

$$MC_N = TVC_N - TVC_{N-1}$$

To explain how it is calculated, look at the following Table.

Table 18.4

Output of pens (1 unit = 100 pens)	Total cost (₹)	Marginal cost (₹)
0	60	–
1	120	60
2	160	40
3	210	50
4	320	110
5	450	130

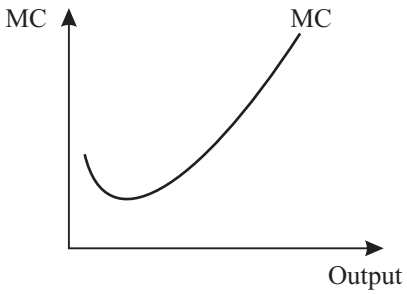


Fig. 18.7

When output level is zero, total cost is ₹ 60. As one unit of pen is produced by the producer the total cost rises to ₹ 120. So the marginal cost of producing one unit of output is ₹ 60 (₹ 120-₹ 60). When it produces 2 units his total cost increases to ₹ 160; the marginal cost at 2 units of output is ₹ 40 (₹ 160-₹ 120). This has been calculated by deducting total cost of 1 unit from total cost of 2 units. Marginal cost at one unit of output is ₹ 60. This we got by deducting total cost of zero unit from total cost of one unit.

It should be kept in mind that marginal cost is dependent on the variable cost only. It is not affected by fixed cost because fixed cost remains constant. As output expands, changes in total cost are due to changes in variable cost only. So, marginal cost can also be calculated if only total variable costs are known to us. For example, take the following Table 18.5 showing TFC, TVC and TC. When we calculate MC from either TC or TVC we get the same result. Calculate yourself and the check the result.

Table 18.5

Output of pens (1 unit = 100 pens)	Total cost (₹)	TFC (₹)	TVC (₹)	MC (₹)
0	60	60	0	–
1	120	60	60	60
2	160	60	100	40
3	210	60	150	50
4	320	60	260	110
5	450	60	390	130

INTEXT QUESTIONS 18.5

Fill in the blanks:

(i) Marginal cost is the ..... cost incurred on additional unit of output.

(ii) Marginal cost equals the change in total cost or the change in ..... per unit change in output.

(iii) Output increases from 3 units to 4 units. As a result TC rises from ₹ 19.60 to ₹ 24.50. MC is .....

18.11 RELATIONSHIP BETWEEN AC, AVC AND MC

The relationship between AC, AVC and MC can be illustrated with the help of the table 18.6 and diagram 18.8.

Output (Units)	TVC (₹)	AVC (₹)	MC (₹)
0	0	–	–
1	6	6	6
2	10	5	4
3	15	5	5
4	24	6	9
5	35	7	11

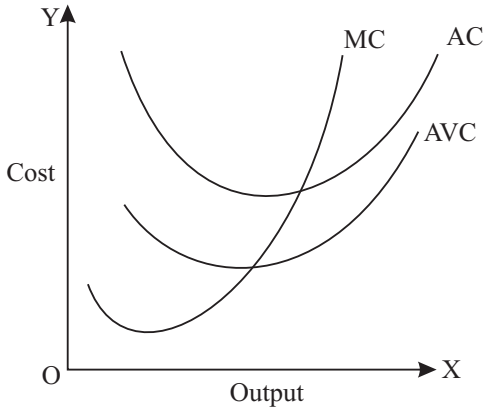


Fig. 18.8

(a) Relationship between AC and MC

(i) When MC is less than AC, AC falls with increase in the output

(ii) When MC becomes equal to AC, AC becomes minimum and constant.

(iii) When MC is more than AC, AC rises with increase in the output.

(b) Relationship between AVC and MC

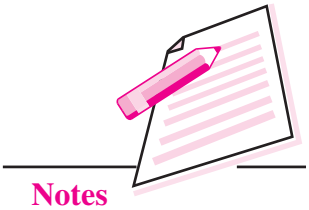
(i) When MC is less than AVC, AVC falls with increase in the output

(ii) When MC becomes equal to AVC, AVC becomes minimum and constant.

(iii) When MC is more than AVC, AVC rises with increases in the output

WHAT YOU HAVE LEARNT

- In Micro Economics, cost is the sum of (a) explicit cost (b) implicit cost and (c) normal profit. It is different from cost used in business which includes only explicit cost.
- Explicit cost is the cost of inputs hired and purchased from the market. It is also called money cost.
- Implicit cost is the cost of the inputs which are owned and supplied by the entrepreneur himself in the production of a commodity. It is equal to the opportunity cost of these inputs.
- Normal profit is the minimum supply price of the entrepreneur which he must get in order to remain in the present business.
- Private cost is the cost which a firm has to incur in the production of a commodity.
- Social cost is the cost to the society as a whole for producing a commodity in the form of air-pollution, water-pollution and noise pollution etc.
- Fixed costs are the costs which do not change with change in the level of output.
- Variable costs are the costs that directly vary with changes in the level of output.
- Total cost is the sum of Total Fixed Cost (TFC) and Total Variable Cost (TVC).
- Average Fixed Cost is the per unit fixed cost of the output produced. It goes on decreasing with increase in output.
- Average Variable Cost (AVC) is the per unit variable cost of output produced.
- Average Total Cost (ATC) is the sum of the AFC as AVC.
- Marginal Cost (MC) is the addition to TC/TVC by the production of an additional unit of the product.



TERMINAL EXERCISE

1. What is implicit cost? How is it different from explicit cost?
2. What is explicit cost? Distinguish it from implicit cost.
3. Explain the concept of 'normal profit'. Justify that it is an element of cost in micro economics.
4. Explain the various elements of cost in micro economics.
5. Differentiate between the concepts of cost as used in business and in micro economics.
6. Distinguish between fixed cost and variable cost with suitable examples.
7. Explain the relationship between output and average fixed cost.
8. Distinguish between AFC and AVC and describe how these are calculated.
9. Explain the term 'marginal cost'. Show with the help of an example how is it calculated.
10. Which cost, fixed or variable, determines marginal cost? Give reasons.
11. Classify the following expenditure into explicit cost and implicit cost:
    (a) A farmer growing seeds and using them for cultivation
    (b) Use of chemical fertilizers by a farmer.
    (c) Use of the services of a tractor owned by the farmer
    (d) Farming by the farmer who owns the land
    (e) Unpaid family labour used on farms
    (f) Transport charges
    (g) Interest on borrowings
    (h) Wages paid
    (i) Use of own building for production
    (j) Excise duty.
12. Classify the following expenditure into fixed cost and variable cost :
    (a) Rent of the factory building
    (b) Wages to watchman
    (c) Annual licensing fee of factory premises
    (d) Raw material
    (e) Rent of the agricultural land

(f) Seeds

(g) Fertilizers

(h) Interest on borrowings

(i) Excise duty

(j) Transport charges.

13. Calculate total cost, average total cost, average fixed cost, average variable cost and marginal cost on the basis of the following information:

Output (units)	TFC	TVC
0	60	0
1	60	50
2	60	90
3	60	180
4	60	300

14. Calculate (i) TFC and TVC (ii) AFC and AVC and (iii) MC from the following data :

Output (units)	TC
0	180
1	300
2	400
3	510
4	720
5	1000

15. Suppose that TFC is ₹ 120, find out

TC, TVC and MC from the following data :

Output (units)	ATC (₹)
1	240
2	160
3	~140
4	160
5	180

16. Fill in the blanks :

Output (units)	TC	TFC	TVC	MC
0	12	-	-	-
1	20	-	-	-
2	24	-	-	-
3	30	-	-	-
4	44	-	-	-

17. Complete the following table :

Output (units)	Total fixed cost	Total cost	ATC	Marginal cost	AFC
0	8			–	8
1				12	
2				10	
3				8	
4				6	
5				5	

ANSWERS TO INTEXT QUESTIONS

18.1

1. (i) explicit cost
   (ii) is
2. Explicit cost: (ii) (iii) (iv) (v) and (vii)
   Implicit cost: (i) and (vi)

18.2

(i) False (ii) True (iii) True (iv) True (v) False

18.3

(i) variable cost (ii) add (iii) is not (iv) fixed cost

Notes

18.4

(i) cost per unit (ii) multiply (iii) falls (iv) average fixed cost, average variable cost

18.5

(i) additional (ii) Total variable cost (iii) ₹ 4.90

Terminal Exercise

1. Read section 18.3 (b)
2. Read section 18.3 (a)
3. Read section 18.3 (c)
4. Read section 18.3
5. Read section 18.3
6. Read section 18.5
7. Read section 18.7 (a)
8. Read section 18.7 (a, b)
9. Read section 18.8
10. Read section 18.8
11. Explicit costs : b, f, g, h, j
    Implicit costs : a, c, d, e, i
12. Fixed cost: a, b, c, e, h
    Variable cost: d, f, g, i, j
13.

Total Cost (₹) TFC+TVC	AFC	AVC	ATC	MC
60	-	-	-	-
110	60	50	110	50
150	30	45	75	40
240	20	60	80	90
360	15	75	90	120

14.

Output (units)	TC ₹	TFC ₹	TVC ₹	AFC ₹	AVC ₹	MC ₹
0	180	180	0	-	-	-
1	300	180	120	180	120	120
2	400	180	220	90	110	100
3	510	180	330	60	110	110
4	720	180	540	45	135	210
5	1000	180	820	36	164	280

15.

Output (units)	ATC	TC	TFC	TVC	MC
1	240	240	120	120	120
2	160	320	120	200	80
3	140	420	120	300	100
4	160	640	120	520	220
5	180	900	120	780	260

16.

Output (units)	TC ₹	TFC ₹	TVC ₹	MC ₹
0	12	12	0	-
1	20	12	8	8
2	24	12	12	4
3	30	12	18	6
4	44	12	32	14

17.

Output (units)	Total fixed cost	Total cost	Marginal cost	ATC	AFC
0	8	8	-	-	-
1	8	20	12	20	8
2	8	30	10	15	4
3	8	38	8	12.66	2.66
4	8	44	6	11.00	2.00
5	8	49	5	9.80	1.60

Notes

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19

SUPPLY

We have already studied about the meaning of demand, factors determining demand and the law of demand etc. the demand for the commodities comes from the buyers of the commodities. But the buyers can purchase a commodity only when it is available in the market. The firms produce goods and services which are demanded by the households for the satisfaction of their wants. Firms have to incur some expenditure on the purchase of inputs required for producing the goods and services. They get revenue by selling these goods and services. In this process, the firms have an objective of earning maximum profit. The focus of this chapter is to understand why a firm or a seller is willing to sell its product in the market. We assume that there are no intermediaries in the market, so the firm is also the seller of the commodity.

OBJECTIVES

After completing this lesson, you will be able to:

- define supply;
- discuss the factors that affect the supply;
- know the meaning of supply function;
- prepare a supply schedules from supply function;
- state and explain the law of supply;
- differentiate between individual and market supply;
- prepare and individual and market supply schedule;
- draw an individual and market supply curves;
- distinguish between change in supply and change in quantity supplied; and
- differentiate between movement along a supply curve and shift of supply curve.

19.1 MEANING OF SUPPLY

supply a commodity by a firm or seller **may be defined as the quantity of a commodity that a firm or seller offers for sale at a given price during a given time period.** But the actual sale of the commodity may be different from its supply. For example a farmer (produced of wheat) is willing to sell 50 quintals of wheat at a price of ₹ 15 per kg but he is able to sell only 30 quintals at this price. So this case the supply of wheat is 50 quintals but the actual sale is 30 quintals. So these two concepts should not be confused with each other. Like demand supply also has three elements. The definition of supply include (i) the quantity of the commodity that a firm is willing to supply (ii) the price at which it is willing to supply that quantity and (iii) the time period during which it is willing to supply that quantity.

19.2 FACTORS DETERMINING SUPPLY OR DETERMINANTS OF SUPPLY OF A GOOD

The main determinant of supply is the price of the commodity. But the cost of production of a commodity is an important factor in determining profit maximized on output of a firm. The cost of production depends on the prices of various inputs, like raw material, wages of workers, interest of capital, rent of building etc. The supply of a commodity also depends on the technology used in the production of the commodity and many other factors. The main factors determining supply of a commodity are

(i) Price of the commodity

(ii) Price of other related good

(iii) Price of inputs/factors

(iv) Taxation policy of government

(v) Objective of the firm

(i) Price of the commodity: Other factors determining supply remaining constant, there is a direct relationship between price and quantity supplied of a commodity. It means the quantity supplied of a commodity increases with rise in price and decreases with fall in price of the commodity. More quantity of a commodity is supplied at a higher price and less quantity is supplied at a lower price. For example a seller of tomatoes is willing to sell 100 kgs of tomatoes at a price of ₹ 40 per keg and only 50 kgs at a price of ₹ 20 per kg. Due to this direct relationship between price and quantity supplied of a commodity the supply curve has a positive slope. Supply curve is upward sloping to the right.

(ii) Price of other related goods: Supply of a commodity is also influenced by the change in the price of other related goods. With the help of given resources

Notes

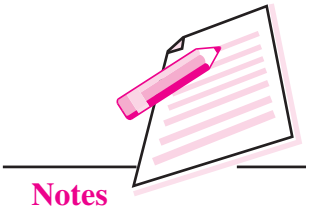
we can produce several goods by using the same technology. This helps the firm to diversify and tide over fluctuations in demand. For example, a farmer can produce either pulses or food grains by using the resources. If the price of pulses increases it becomes more profitable for him to make more production of pulses. So he will divert some resources from the production of food grains to the production of pulses. The production of pulses will increase and that of food grains will decrease. So the supply of pulses will increase if the price of pulses increases and the supply of food grain will decrease at the same price reverse will happen if the price of food grains increases.

(iii) Price of inputs/factors: Change in the price of inputs like raw material, wage, rent or interest also influences the supply of a commodity. For example, in the production of cloth, cotton is the main raw material. If the price of cotton increases, the cost of production of cloth will increase. At the same price, the margin of profit will decrease. So the producer will decrease the supply of cloth at the same price. On the other hand if the price of cotton falls, the cost of production per unit of cloth will decrease and hence the supply of cloth will increase. The price of other inputs will also influence the supply of a good in the same manner.

(iv) Technology of production: an improvement in the technology of production of a commodity decreases the per unit cost of the commodity. The margin of profit will increase at the same price. So the supply of a commodity will increase, with improvement in technology of production, at the same price. On the other hand if a firm uses absolute technology of production, the cost of production per unit of the commodity will increase. The margin of profit will decrease, so the firm will decrease its supply at the same price. This is the main reason that the firms are trying to use better technology of production because it not only reduces the cost of production per unit but also improves the quality of the product.

(v) Taxation policy of government: If the government reduces the excise duty or the production of a commodity, the cost of production per unit of the commodity will decrease, the margin of profit will increase at the same price so the producer of the commodity will increase its supply. It happens when the government wants to increase the production of the commodity. On the other hand to discourage the production of some harmful goods, like cigarettes, liquor etc, the government increases the rate of excise duty on the production of such goods. So the cost of production per unit of the commodity increases and the supply of such commodities decreases.

(vi) Objective of the firm: The objective of the producer also influences the supply of a commodity. Generally, the objective of a producer is get maximize his profits. Profits are maximized at a higher price. So he increases the supply



of a commodity at a higher price and decreases its supply at a lower price. But sometimes, the producer may be in maximizing his sales and not in maximizing his profits as he wants to capture the market. In that case, he goes on increasing the supply so long his target is not achieved can profit is not adversely affected. He may increase the supply at the same price to any extent.

INTEXT QUESTIONS 19.1

1. Define supply.
2. What is the meaning supply?
3. State any three determinants of supply.
4. How does technological progress influence the supply of a commodity?
5. What is the effect of change in price of inputs on the supply of a commodity?
6. How does change in the price of other related goods affect the supply of a commodity?

19.3 SUPPLY FUNCTION

When the relationship between quantity supplied and the determinants of supplied is expressed mathematically in an equation, it is called a supply function. So a supply function can be expressed as:

$$S_n = f(P_n, P_r, P_f, T, T_r, G)$$

where S_n = Supply of commodity n

Pn = Price of the commodity n

Pr = Price of other related goods

Pf = Price of inputs/factors

T = Technology of production

Tr = Government policy or tax rate

G = Goal or objective of the producer

Typically supply function shows the relationship between price and quantity supplied, keeping all other determinants of supply as constant. It shows the amount of a good that a seller supplies at different levels of price.

For example, a supply function can be

$$qs = -15 + 3P$$

Notes

In the above equation quantity supplied qs is a function of price P. The sign before p is always positive which indicates that the price and quantity supplied are directly related and the supply curve is upward sloping to the right. Here +3 means that the every unit increase in price there is an increase of 3 units in supply. –15 in the supply function represents the point at which the supply cur e cuts x-axis.

We can derive a supply schedule with the help of supply function.

Table 19.1: Supply schedule of commodity x

Price of unit (₹)	Quantity supplied per unit of time (units)
5	0
6	3
7	6
8	9
9	12

The above table shows that for the price levels more that ₹ 5, there is a positive quantity supplied. But for ₹ 5, or less than ₹ 5, the supply of commodity x is zero because supply can not be negative.

19.4 LAW OF SUPPLY

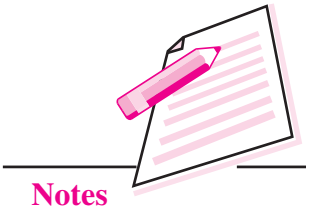
The law of supply depicts the relationship between price and quantity supplied of a commodity when all other determinants of supply remain constant. This law states that there is a direct relationship between price and quantity supplied of a commodity, other factors determining supply remaining constant. It means quantity supplied of a commodity increases with increase in price and decreases with decrease in price.

19.4.1 Assumptions of the law of supply

The phrase other determinants of supply remaining constant in the law of supply shows the assumptions of the law of supply. The mains factors which influence the supply of a commodity one, price of the commodity, price of other related goods, price of inputs, technology of production, taxation policy of the government and objective of the firm etc. The law of supply is based on the assumptions that all these factors determining supply except price of the commodity should remain constant. The following are the main assumptions of the law of supply.

(i) Price of other related goods should remain the same

(ii) There should be no change in the price of inputs (factors)



(iii) Technology of production should not change.

(iv) There is no change in the taxation policy of the government.

(v) Objective of the firm should not change

The law of supply is based on the assumptions that the supply of commodity changes only due to change in price when all other determinant of supply remain constant.

19.4.2 Individual and Market Supply

Individual Supply

Individual supply refers to the quantity of a commodity which an individual firm is willing to sell at a given price during a given period of time. It is related with the supply of an individual firm.

Market Supply

Market supply is the collective supply of all the firms in the market of a commodity at a given price during a given period of time. Market supply tells us the told availability of a commodity which can be used to meet the total element of the commodity. **Market supply can be desired by summing up the supply of all the individual firms in the market.**

19.4.3 Supply Schedule

Supply schedule is a table showing different quantities of a commodity that a firm is willing to sell at different prices during a given period of time. Supply schedule can be of two types.

(i) *Individual supply schedule:* When we represent a single firm, willingness to sell different quantities of a commodity at different prices during a given time period, we get individual supply schedule.

(ii) *Market supply schedule:* **Market supply schedule is constructed by summing up the supplies of all the individual firm at different prices during a given period of time.** A market supply schedule is a table showing the total supply of a good by all the firms at different price during a given time period . Market supply schedule can be explained with the help of the following table.

Market supply schedule for sugar

Price per kg (₹)	Quantity supplied of sugar by firm A (kgs)	Quantity supplied by firm B (kgs)	Quantity supplied by firm C (kgs)	Market supply A + B + C (kg)
25	100	200	0	300
30	200	300	100	600
35	300	400	200	900
40	400	500	300	1200
45	500	600	400	1500

In the above table we see that at a price of ₹ 25 per kg the firms A, B and C willing to sell 100, 200 and 0 kgs of sugar respectively. So the market supply as ₹ 25 is 100 + 200 + 0 = 300 kgs of sugar. In the same way the market supply has been calculated at other prices also. The market supply is influenced by the number of firms in the market.

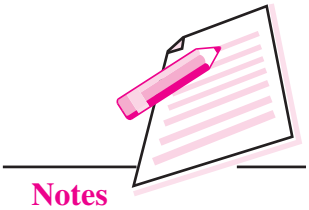
19.4.4 Supply Curve

Supply curve is the graphical presentation of a supply schedule. It shows the quantity that all the firms in the market are willing to supply at a given price during a given time period when all other factors influencing supply remain constant. Supply curve is also of two types.

(i) **Individual supply curve:** Graphical presentation of individual supply schedule is called individual supply curve. It shows the different quantities of a commodity, an individual firm is willing to sell at different prices during a given time period.

(ii) **Market supply curve: Market supply can be derived by horizontal summation of all individual supply curve:** It show the different quantities of a commodity that all the firms are willing to sell at different prices during a given time period.

Let us assume that these are only 3 firms supplying sugar in the market. The supply curves of these firms are represented by SA, SB and SC respectively. If a t ₹ 30 per kg each firm is willing to sell 200, 300 and 100 kgs of sugar respectively. The market supply at ₹ 30 per kg is the sum of a the supply of the three firms 200 + 300 +100 = 600 kgs of sugar. This gives us one point A on the market supply curve as shown in the figure given below.



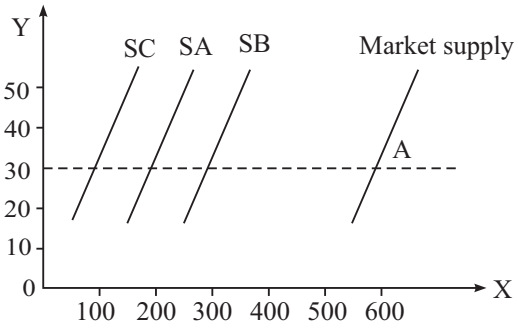


Fig. 19.1

INTEXT QUESTIONS 19.3

(i) State the law of supply.

(ii) Define market supply.

(iii) What is supply schedule?

(iv) How is market supply schedule deviated from individual supply schedule?

(v) What is supply curve?

(vi) How is market supply curve derived from individual supply curves?

(vii) Explain the law of supply with the help of a schedule and a diagram.

19.5 FACTORS DETERMINING SUPPLY

All the factors determining supply of a commodity can be classified into two parts.

(i) Price of the commodity

(ii) Other factors determining supply

This classification is based on the fact that the law of supply or the supply curve shows the relationship between price and quantity supplied of a commodity when all other determinants of supply remain constant.

(i) Price of the commodity: In the law of supply we have studied that the quantity supplied of a commodity increases with increase in priced and decrease with decrease in price all other determinants of supply remaining constant. These increase and decrease in supply are also termed as expansion and contraction of supply respectively. Expansion of supply is shown through

an upward movement along the same supply curve on the other hand contraction of supply is shown through downward movement on the same supply curve.

Movement along the supply curve or expansion and contraction of supply can be explained with the help of the following diagram.

In the above figure initial price and quantity supplied are OP and OQ respectively. When the price increased from OP to OP1, the quantity supplied increases from OQ to OQ1. This is shown by upward movement from point A to point B on the same supply curve. This upward movement of the same supply curve shows the expansion of supply.

On the other hand wen the price falls from OP to OP2, the quantity supplied decreases from OQ to OQ2. This is shown by downward movement from point A to point C on the same supply curve. This downward movement on the same supply curve shows the contraction of supply.

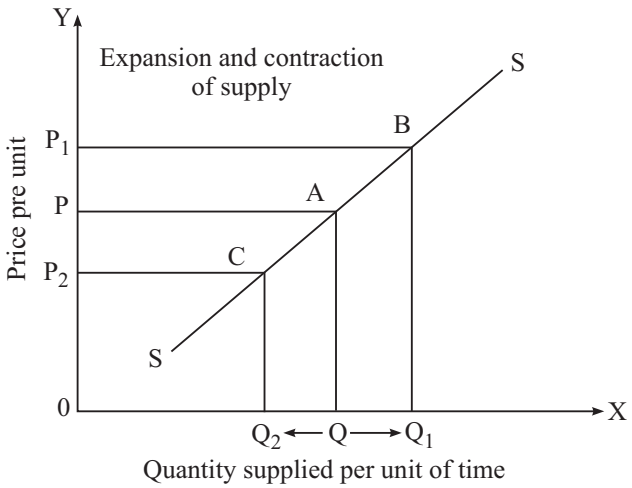
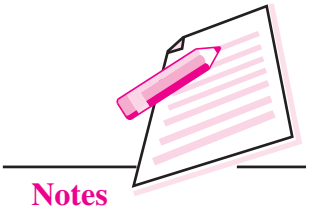


Fig. 19.2

We can say that change in price of the commodity leads to change in quantity supplied of the commodity. It is shown by movement on the same supply curve. Increase in quantity supplied reflects expansion of supply and decrease in quantity supplied reflects contraction of supply.

(ii) Other factors determining supply: But if there is change in factors other than the price of the commodity, then either more is supplied at the same price or less supplied at the same price. In such cases, the price of the commodity remains constant but there is a change in other factors like change in the price



of inputs, change in technology of production, change in price of other related goods, change in taxation policy of the government etc.

For example, there is an improvement in the technology of production of the commodity in question. It leads to decrease in per unit of cost production of the commodity. The firm is willing to sell more quantity of the commodity at the same price. So the supply other commodity increases at the same price. This increase in supply is shown by rightward shift of supply curve.

On the other hand if the firm uses inferior technology of production, the cost of production per unit of the commodity increases. The firm is willing to sell less quantity at the same price. So the supply of the commodity decreases at the same price. This decrease in supply is shown by leftward shift of the supply curve.

The above cases of increase and decrease in supply can be shown with the help of the following figures.

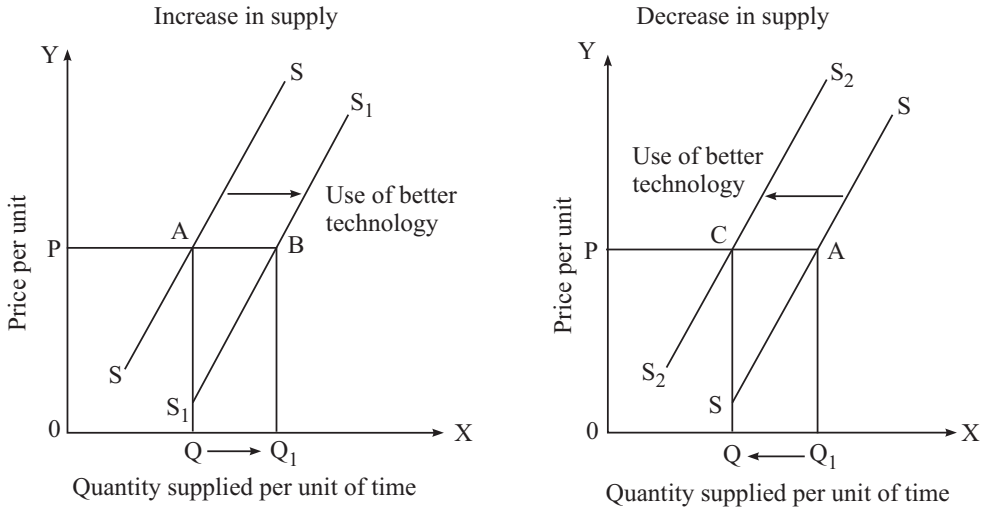


Fig. 19.3

19.5.1 Main factors causing increase in supply or rightward shift of supply Curve

(i) Fall in the price of other related goods

(ii) Fall in the price of inptus/factors

(iii) use of better technology in production

(iv) Decrease in the rate of excise duty by government

(v) If the objective of producer changes from profit maximization to sales maximization

Notes

19.5.2 Main factors causing decrease in supply or leftward shift of supply curve

(i) Increase in the price of other related goods

(ii) Rise in the price of inputs/factors

(iii) use of inferior technology in production

(iv) Increase in the rate of excise duty by the government

(v) If the objective of the producer changes from soles maximization to profit maximization.

INTEXT QUESTIONS 19.4

(i) If the quantity supplied of a commodity falls only due to rise in its price, what is that fall is supply called?

(ii) If the supply of a commodity rises due to improvement in technology, what is that rise in supply called?

(iii) State any three factors causing increase in supply of a commodity.

(iv) State any three factors causing decrease in supply of a commodity.

(v) State any three factors causing rightward shift of supply curve.

(vi) State any three factors causing leftward shift of supply curve.

(vii) Distinguish between expansion in supply and increase in supply.

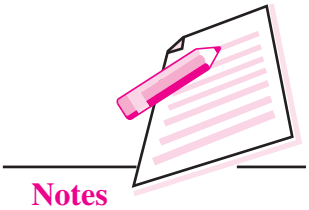
(viii) Distinguish between decrease in supply and contraction in supply

(ix) Distinguish between movement along the same supply curve and shift of supply curve.

(x) Distinguish between change in quantity supplied and change in supply.

WHAT YOU HAVE LEARNT

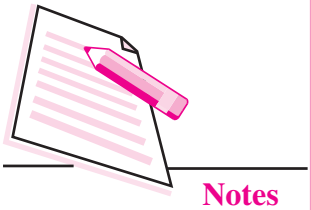
- Supply of a commodity refers to the quantity of a commodity that a seller is willing to sell at a given price during a specific period of time.
- Supply of a commodity is influenced by the factors (i) price of the commodity (ii) price of other related good (iii) Price of inputs/factor (iv) Technology of production (v) Taxation policy of the government (vi) Objective of the firm
- When the relationship between quantity supplied and determinants of supply is represented in a mathematical equation, it is called a supply function.



- The law of supply states that other factors determining supply remaining constant, there is a direct relationship between price and quantity supplied of a commodity.
- Supply schedule is a table which shows the different quantities of acommodity supplied at different prices.
- Supply curve is graphical presentation of supply schedule.
- Market supply schedule can be obtained by summing up all individual supply schedules.
- Market supply curve can be obtained by horizontal summation of all individual supply curves.
- Change in quantity supplied takes place only due to change in the price of the commodity.
- Change in supply takes place due to change in factors other than the price of the commodity.
- Increase in supply leads to rightward shift of supply curve and decrease in supply leads to leftward shift supply curve.
- Expansion of supply leads to upward movement and contraction of supply leads to downward movement on the same supply curve.

TERMINAL EXERCISE

1. Give the meaning of the term supply.
2. Explain in brief the various determinants of supply.
3. Define supply function.
4. Explain the law of supply and point out the main assumptions behind this law.
5. Distinguish between a supply schedule and a supply curve.
6. How is market supply curve derived from individual supply curves?
7. State the curves of increase in supply
8. How is it possible that a seller is ready to sell less quantity of commodity even at the same price.
9. Distinguish between movement along the supply curve and shift of supply curve.
10. Distinguish between decrease in supply and contraction of supply.



Notes

ANSWERS TO INTEXT QUESTIONS

19.1

1. Read section 19.1
2 Read section 19.1
3. Read section 19.2
4. Read section 19.2 (iv)
5. Read section 19.2 (iii)
6. Read section 19.2 (ii)

19.2

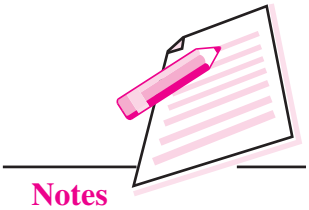
(i) Price = 3
(ii) Price = 8
(iii) Quantity = 28

19.3

(i) Read section 19.4
(ii) Read section 19.4.2
(iii) Read section 19.4.3
(iv) Read section 19.4.3 (ii)
(v) Read section 19.4.4
(vi) Read section 19.4..4 (ii)
(vii) Read section 19.4

19.4

(i) Read section 19.5 (i)
(ii) Read section 19.5 (ii)
(iii) Read section 19.5.1
(iv) Read section 19.5.2
(v) Read section 19.5.1
(vi) Read section 19.5.2
(vii) Read section 19.5 (i) and 19.5 (ii)
(viii) Read section 19.5 (i) and 19.5 (ii)
(ix) Read section 19.5 (i) and 19.5 (ii)
(x) Read section 19.5 (i) and 19.5 (ii)



20

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PRICE ELASTICITY OF SUPPLY

The law of supply tells us the direction of relationship between price and quantity supplied of a commodity. But it does not tell us about the quantum of change in supply due to a certian change in price of the commodity. For this purpose, we have to study the concept of elasticity of supply. This lesson will focus on concepts related with elasticity of supply. We will also learn how to measure price elasticity of supply.

OBJECTIVES

After completing this lesson, you will be able to:

- define price elasticity of supply;
- understand different degrees of price elasticity of supply;
- represent different degrees of price elasticity of supply;
- explain the percentage method of calculating price elasticity of supply;
- solve numerical example of price elasticity supply;
- understand the geometric method of calculating price elasticity of supply; and
- identify factors affecting price elasticity of supply.

20.1 MEANING OF PRICE ELASTICITY OF SUPPLY (e_s)

Price elasticity of supply measures the degree of responsiveness of quantity supplied of a commodity to change in its price. But the problem is that all the commodities do not respond in the same way to change in price. Some commodities are more responsive to change in price than others. For example, if the price of a commodity increases by 20 percent and it quantity supplied increase by 40 percent. In this case the supply of the commodity is very elastic because percentage in quantity supplied of the commodity is double the percentage change in its price.

We can explain it with the help of the following supply curves.

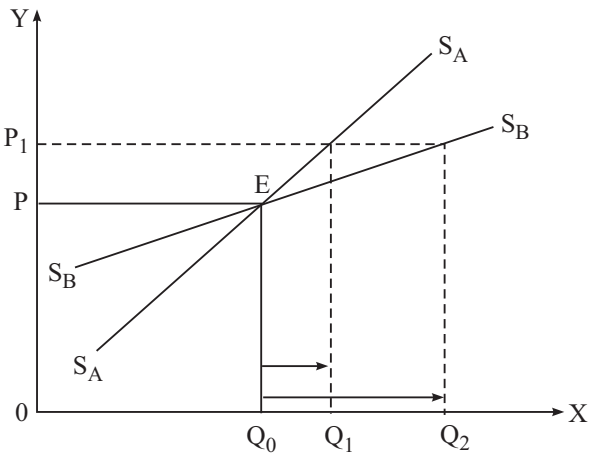


Fig. 20.1

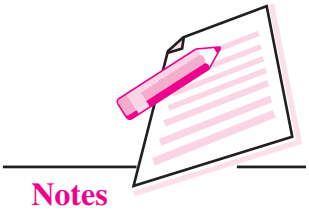
In the above figure there are two commodities A and B′ supply curve for commodity A is represented by S_AS_A and for commodity B by supply curve S_BS_B. At price OP the quantity supplied of both the commodities is OQ_0. But when the price increases to OP_1, the quantity supplied of commodity A in areas to OQ_1 and that of commodity B increased to OQ_2. The distance of OQ_0 to OQ_2 is greater than the distance of OQ_0 to OQ_1. So the increase in quantity supplied of commodity B is more than increase in quantity supplied of commodity A. So we can say that the price elasticity of supply of commodity B is more than the price elasticity of supply of commodity A. We can easily notice in the figure that the supply curve of commodity B is flatter than the supply curve of commodity A. So we can easily conclude that the elasticity of supply at flatter supply curve is more than a steeper supply curve.

$$e_s = \frac{\% \text{ change in } Q_x}{\% \text{ change in } P_x}$$

where Q_x = Quantity of good , P_x = Price of good x

20.2 DEGREES OF PRICE ELASTICITY OF SUPPLY

The co-efficient of price elasticity of supply varies from zero to infinity. On the basis of co-efficient of price elasticity of supply the following five degrees of price elasticity of supply are taken into consideration



(i) Perfectly inelastic supply ($e_s = 0$)

(ii) Inelastic or less than unit elastic supply ($e_s < 1$)

(iii) Unitary elastic supply ($e_s = 1$)

(iv) Elastic or more than unit elastic supply ($e_s > 1$)

(v) Perfectly elastic supply ($e_s = \infty$)

The explanation of each is given below.

(i) Perfectly inelastic supply ($e_s = 0$)

Supply of a commodity is said to be perfectly inelastic when the quantity supplied of a commodity does not change at all in response to change in price of the commodity. It means that the price of the commodity may increase or decrease but its quantity supplied remained the same. In such cases the price elasticity of supply is zero and supply curve is a vertical line parallel to y-axis. It can be explained with the help of the following supply schedule and supply curve.

Supply schedule of eggs

Price per dozen (₹)	Quantity supplied (in dozens)
10	50
20	50
30	50

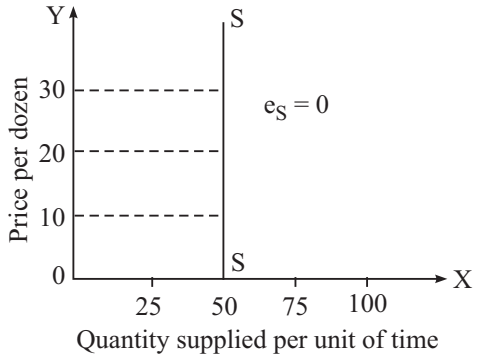


Fig. 20.2

In the above supply schedule and curve we see that the quantity supplied of the egg remains at 50 dozens whether the price is ₹ 10 or ₹ 20 or ₹ 30 per dozen.

(ii) Inelastic or less than unit elastic supply ($e_s < 1$)

When the percentage change in quantity supplied of a commodity is less than the percentage change in its price, the supply of the commodity is said to be inelastic or less than unit elastic. It happens generally in case of perishable goods as it is very difficult to store them. It is shown in the following supply schedule and supply curve.

Supply schedule of tomatoes

Price per kg (₹)	Quantity (Quintals)
20	100
40	150

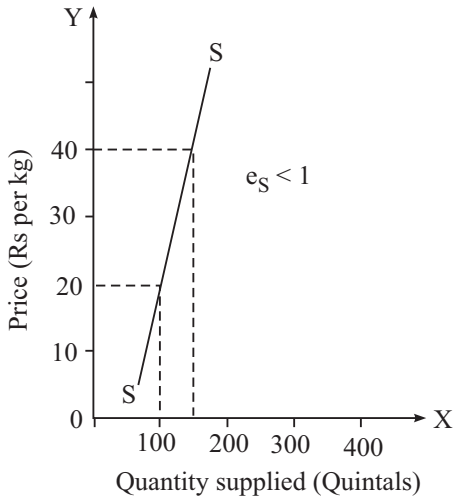
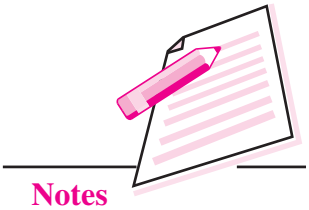


Fig. 20.3

In the above supply schedule the quantity supplied of the tomatoes has increased only 50 percent in response to 100 percent increase in its price. The supply curve if extended touches x-axis to the right of the origin. In such cases the supply curve has a steeps slope and price elasticity of supply is less than one but greater than zero.

(iii) Unitary elastic supply ($e_s = 1$)

When the percentage change in quantity supplied of a commodity is equal to percentage change in its price, the supply of the commodity is said to be unitary elastic. It means if the price of the commodity increases by 50 per cent its quantity supplied will also increase by 50 percent. It can be explained with the help of the following supply schedule and supply curve.



Supply schedule of commodity X

Price per unit (₹)	Quantity supplied (units)
10	20
20	40
30	60

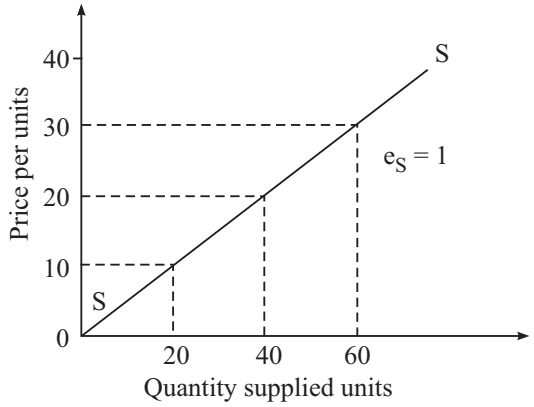


Fig. 20.4

The above supply schedule of commodity X shows that when the price increases by 100%, quantity supplied also increases by 100% and when the price increases by 50%, the quantity supplied also increases by 50%. The supply curve is passing through point of origin.

(iv) Elastic or more than unit elastic supply ($e_s > 1$)

When the percentage change in quantity supplied of a commodity is greater than the percentage change in its price, the supply of the commodity is said to be greater than unit elastic. It happens in case of durable goods because if the price falls they can be easily stored for future sale. If the price of such goods falls by 20%, their quantity supplied falls by more than 20%. In such cases, price elasticity of supply is greater than one. It can be explained with the help of the following supply schedule and supply curve.

Supply schedule of commodity A

Price per unit (₹)	Quantity supplied (units)
10	20
20	50

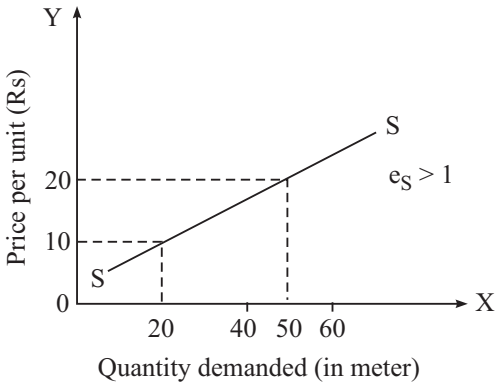


Fig. 20.5

In the above supply schedule price of the commodity increases by 100% but its quantity supplied increases by 150%. Thus, in this case, supply is more than unitary elastic.

(v) Perfectly elastic supply ($e_s = \infty$)

When the quantity supplied of a commodity expands or contracts to any extent without any change or with an infinitely small change in its price, the supply of the commodity is called perfectly elastic. Its supply curve is a horizontal line parallel to x-axis. It can be shown with the help of the following supply schedule and supply curve.

Supply schedule of commodity B

Price per units (₹)	Quantity supplied (units)
10	100
10	200
10	300
10	400

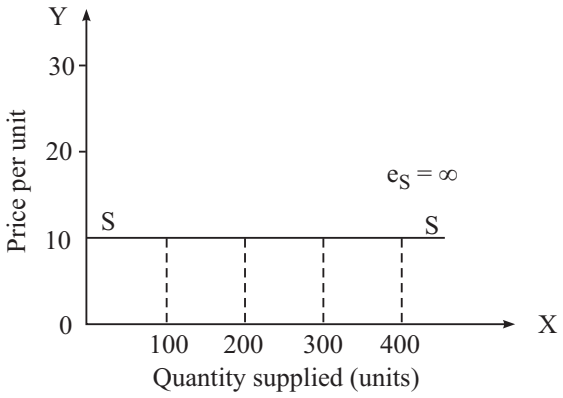
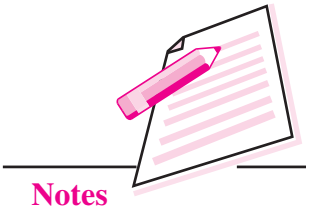


Fig. 20.6



The above supply schedule and supply curve show that at a price of ₹ 10 per unit the quantity supplied of the commodity may be 100, 200, 300 or 400 units. This type of supply is unrealistic because it is not possible in real life.

INTEXT QUESTIONS 20.1

1. Define price elasticity of supply.
2. What is the co-efficient of perfectly elastic supply.
3. What is the main feature of unitary price elasticity of supply.
4. What is price elasticity of supply if the supply curve cut y-aixs at a point above the point origin.
5. What is price elasticity of specify if the supply curve cuts x-axis in the positive range.
6. Define perfectly price inelastic supply.

20.3 MEASUREMENT OF PRICE ELASTICITY OF SUPPLY

After knowing various degrees of price elasticity of supply we have to understand the methods of calculating price elasticity of supply. At this stage we shall discuss the following two methods that are used for calculating price elasticity of supply.

(i) Percentage or Proportionate method

(ii) Geometric method

Detailed description of each method is given below:

20.3.1 Percentage or proportionate method

This is the most popular method of measurement of price elasticity of supply. With the help of this method we can calculate the accurate value of price elasticity of supply. This method measures the degree of responsiveness of quantity supplied of a commodity to change in its price. The price elasticity of supply is the ratio of percentage change in quantity supplied of a commodity to percentage change in its price. It can be calculated with the help of the following method:

$$e_s = \frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$$

$$e_s = \frac{\Delta Q_s}{\Delta P} \times \frac{P}{Q_s}$$

Notes

where ΔQ_s = change in quantity supplied

ΔP = Change in price

P = Original price

Q_s = Original quantity supplied

$$\text{Percentage change in quantity supplied} = \frac{\Delta Q_s}{Q_s} \times 100$$

$$\text{Percentage change in price} = \frac{\Delta P}{P} \times 100$$

If we take original price as P_1 and changed price as P_2 this ΔP will be $P_2 - P_1$. In the same way if we take original quantity as Q_1 and changed quantity as Q_2 then ΔQ will be $Q_2 - Q_1$. The value of price elasticity of supply is always positive because there is a direct relationship between price and quantity supplied of commodity. Now we give some solved examples of price elasticity of supply with the help of which we can easily calculate price elasticity of supply of a commodity.

Example 1: Calculate the value of price elasticity of supply of commodity A if the percentage change in price of the commodity is 10% and percentage change in its quantity supplied is 18%.

Solution:

$$e_s = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$$

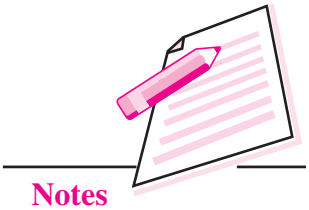
$$e_s = \frac{18}{10} = 1.80$$

Ans: Price elasticity of supply of commodity A is 1.80 (more than unit elasticity supply)

Example 2: A firm sells 40 units of commodity X when its price is ₹ 10. At what price it will sell 60 units of the commodity if its price elasticity of supply is 0.8.

Solution:

$$e_s = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$



By putting the above question in a tabular form

$P_1 = 10$ $Q_1 = 40$

$P_2 = ?$ $Q_2 = 60$

Here $\Delta Q = 60 - 40 = 20$

$\Delta P = P2 - 10$

$e_s = 0.8$

$$0.8 = \frac{20}{P_2 - 20} \times \frac{10}{40}$$

$$0.8 \times 40(P_2 - 10) = 200$$

$$32P_2 - 320 = 200$$

$$32P_2 = 520$$

$$P_2 = 16.25$$

Ans: At a price of ₹ 16.25, the firm will supply 60 units of commodity X.

Example 3: If the price of oranges increases by 40% per kg and its quantity supplied increases from 100 to 125 kgs. Calculate price elasticity of supply of oranges.

$$e_s = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$$

$$e_s = \frac{\frac{125 - 100}{100} \times 100}{40\%}$$

$$= \frac{25\%}{40\%} = 0.625$$

Ans: Price elasticity of supply of oranges is 0.625 (less than units elastic supply)

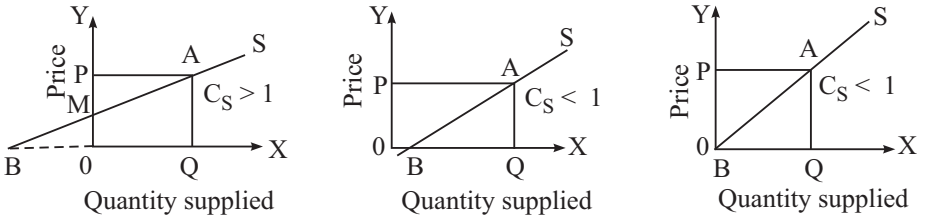
20.3.2 Geometric method

Geometric method is also called the point method of calculating price elasticity of supply as with the help of this method we can calculate price elasticity of supply of a commodity at a point on the supply curve. Under this method we can calculate price elasticity of supply at a given point on the supply curve with the help of the following method. To measure price elasticity of supply at a point we extend the

supply curve so that it meets the x-axis at point B in its negative range, positive range or exactly at the point of origin. For this purpose we use the following formula:

$$e_s = \frac{BQ \text{ (Horizontal segment)}}{OQ \text{ (Quantity supplied)}}$$

See the figures below and use this formula.



(a) (b) (c)

Fig. 20.7

In figure (a) the supply curve cuts price axis at point M. When we extend the supply curve it meets x-axis in its negative range at point B. Price elasticity of supply is calculated as under:

In figure (a) $e_s = \frac{BQ}{OQ} > 1$ because BQ > OQ

So supply curve cutting price axis is elastic in nature.

In figure (b) the supply curve meets x-axis in it positive range at points B. Price elasticity of supply is calculated as under

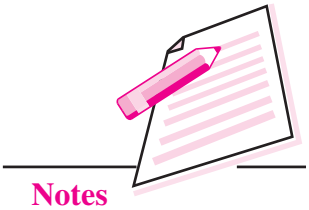
In figure (b) $e_s = \frac{BQ}{OQ} < 1$ because BQ < OQ

Hence supply curve cutting quantity axis is in elastic in nature.

In figure (c) supply curve it meets x-axis at the point of origin. Here the point O and B coincide. Price elasticity of supply is calculated as under:

In figure (c) $e_s = \frac{BQ}{OQ} = 1$ because BQ = OQ

So supply curve through the origin is unitary elastic.



So we can conclude that a straight line supply curve which intersects x-axis in its negative range imply $e_s > 1$. A straight line supply curve which intersect x-axis in its positive range implies $e_s < 1$ and a straight line supply curve which passes through the point of origin implies $e_s = 1$ irrespective of low steep or flat it is.

INTEXT QUESTIONS 20.2

1. When the price of a commodity increases by 20%, its supply increases by 30%. What is the price elasticity of supply?
2. At a price of ₹ 100 per unit, a seller supplies 300 units of a commodity. Calculate price elasticity of supply if he supplies 450 units of the commodity at a price of ₹ 200 per unit.
3. A seller supplies 100 unit of a commodity at a price of ₹ 40 per unit. How much quantity of the commodity will be supply at a price of ₹ 60 per unit if the price elasticity of supply is unity.
4. A seller of commodity A supplies 200 units at a price of ₹ 2 per unit. At which price will he supply 300 units of it, if the price elasticity of supply is 0.5.
5. What is price elasticity of supply of a straight line supply curve passing through the point of origin and making an angle of 70° to the x-axis.
6. What is price elasticity of supply if the straight line supply curve meets x-axis in its negative range.

20.4 FACTORS INFLUENCING ELASTICITY OF SUPPLY

In all the cases, the price and quantity supplied of a commodity are directly related. Here we shall study the factors that determine the degree of elasticity of supply of a commodity to a change in its price. The main factors determining elasticity of supply are given below.

(i) Nature of the commodity

The supply of perishable goods like fresh vegetables and fresh fruits is generally inelastic because it is very difficult to store them for future sale. These goods are prone to getting spoiled quickly and can not be kept for long period of time. So the supply of such goods does not change according to change in price. It is so because the seller prefers to sell them at cheaper rates than to spoil the goods totally.

On the other hand durable goods made by the industries do not get easily spoiled. If the price of such goods falls, they can easily be stored for sale when the price rises. So, the supply of such goods is more elastic to change in price. The goods whose supply can be postponed for future are more elastic than the goods whose supply can not be postponed for future.

(ii) Cost of production of additional units of a good

If the cost of production of additional units of a commodity increases sharply, the profit may not rise even if the price increases. In such cases, the producer is not interested in increasing the production in substantial quantity. The supply of such goods is relatively inelastic.

On the other hand if the marginal cost of additional unit decreases per unit, the producer will be motivated to increase the output with a little increase in price. In such a case the supply of the commodity is more elastic.

(iii) Time Period

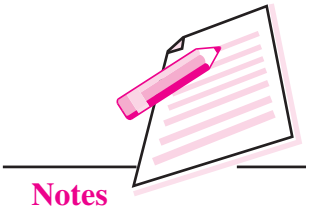
Time period also influences the case with which the supply of the commodity can be changed. During very short period, supply can not be changed according to change in price. So the supply of the commodity is perfectly inelastic. During short period, the supply of the commodity can be changed by changing only variable factor and keeping all other factors as constant. So the supply can be changed only upto a certain extent to change in price. The supply of the commodity in short period is relatively inelastic. But during long period, the supply of the commodity can be changed to any extend by changing all the factor of production. So, in the long period the supply of the commodity can easily be changed. This makes the supply of the commodity more elastic.

INTEXT QUESTIONS 20.3

1. What is the elasticity of supply of a commodity in the short period?
2. What is the value of elasticity of supply in the long period.
3. How does the cost of production of additional units of output influences the elasticity of supply of a commodity.
4. How does nature of the commodity influence the elasticity of supply of a commodity?

WHAT YOU HAVE LEARNT

- Elasticity of supply is the degree of responsiveness of quantity supplied of a commodity to change in its price.
- There are five degrees of price elasticity of supply i.e. (i) perfectly inelastic supply (ii) less than unit elastic supply (iii) unitary elastic supply (iv) more than unitary elastic supply (v) perfectly elastic supply.



- There are two method of measuring price elasticity of supply (i) percentage or proportionate method (ii) geometrical method
- Price elasticity of supply depend on the following factors (i) nature of commodity (ii) cost of production of the additional units (iii) time period.

TERMINAL EXERCISE

1. Define price elasticity of supply.
2. If two supply curves intersect each other at a point which of them is more elastic.
3. What is meant by perfectly elastic supply?
4. What is the distinguishing feature of unitary elastic supply?
5. What is the value of elasticity of supply in very short period?
6. What is the value of elasticity of supply in the long period?
7. State any three factors determining price elasticity of supply.
8. Explain the percentage method of determining elasticity of supply.
9. State the geometric method of measuring elasticity of supply on a straight.
10. Explain the three factors that affect the elasticity of supply.
11. At a price of ₹ 100 per unit, a seller sells 200 unit of the commodity and at a price of ₹ 50 per unit, he sells 100 units of the commodity. Calculate elasticity of supply.
12. Price elasticity of supply of a commodity is 1.5. The seller sells 1000 unit of the commodity at a price of ₹ 4 per unit. How many unit of the commodity will be sold at a price of ₹ 5 per unit.
13. At a price of ₹ 10 per unit, a firm earns total revenue as ₹ 5000. When the price rises ₹ 15, the firm earns ₹ 10000 as total revenue. Calculate its elasticity of supply and comment on it.
14. The price elasticity of supply of a commodity is 3. When its price falls from ₹ 10 to ₹ 8 its quantity suppled falls by 400 units. Calculate quantity supplied at reduced price.

ANSWERS TO INTEXT QUESTIONS

20.1

1. Read section 20.1
2. $e_s \propto$ [Read section 20.1 (v)]

Notes

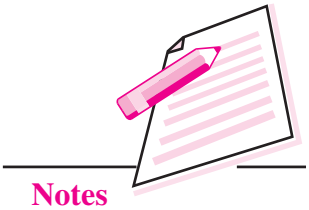
3. Read section 20.1 (iii)
4. $e_s > 1$ [Read section 20.1 (iv)]
5. $e_s < 1$ [Read section 20.1 (iv)]
6. Read section 20.1 (i)

20.2

1. $e_s = 1.5$
2. $e_s = 0.5$
3. Quantity supplied is 150 units
4. Price = 4
5. Unitary elastic
6. $e_s > 1$

20.3

1. $e_s < 1$ [Read section 20.4 (iii)]
2. Read section 20.4 (iii)
3. Read section 20.4 (ii)
4. Read section 20.4 (i)



21

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FORMS OF MARKET

You are familiar with the term market. Market is the major source of distribution of goods and services. The purpose of producing goods is to sell them to the consumers who demand them. To sell the goods (and services) we need the medium of market. In today's world a buyer can get so many types of goods in the market. What are the different forms of market? As students of economics you must know the forms of market. This lesson is denoted for towards this.

OBJECTIVES

After completing this lesson, you will be able to:

- understand the concept of market;
- know the meaning of perfect competition and its features;
- explain the meaning of monopoly and its features;
- understand the meaning of monopolistic competition and its features;
- understand the meaning of oligopoly and its features; and
- draw a comparison among different forms of market.

21.1 WHAT IS A MARKET

Market is the heart and soul of modern economic life. Without market, producers' and consumers' activities hardly make any sense. In common parlance, market is assumed to be a place where goods are bought and sold. But in economics, the term 'market' does not refer to a specific place. Rather, it is a mechanism through which buyers and sellers come into contact with each other and buy and/or sell goods at mutually agreed prices.

Main features of a market include:

(a) **Buyers and Sellers:** Buyers and sellers must come into contact with each other for a market to exist. It is only after the contact between the buyer and the seller, that a transaction takes place.

(b) **Area:** You can easily find a market place nearer to a human settlement. But in today's world, the market is not limited to a particular place. Today, in the age of Internet, we have a rapidly growing online market which is not limited to any geographical area. A buyer can place order to buy a good online. So modern Market exists physically and virtually.

(c) **Commodity:** The transaction between buyer and seller has to be over some good or service. So a commodity becomes the integral part of a market.

(d) **Different forms of Competition:** Forms of market depends on the degree of competition among the sellers selling the goods, where the degree of competition it self is determined by the inter relationship of among the goods and services sold by different sellers as well on number of sellers present in the market.

(e) **Money transaction:** Money is the mediums of exchange in the modern day world. Consumers pay money to the seller to buy goods as services in the market. So money and market are inseparable.

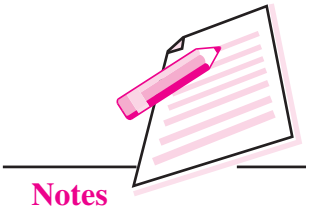
21.2 BASIS OF DIFFERENT MARKET FORMS

Different forms of market can exist on the basis of some distinguished characteristics. Some of these characteristics are:

(a) **Number of Firms:** Number of firms in a market indicates the degree of control of a firm on the price of a commodity. For example, if there is a large number of firms competing against each other, a single firm supplies just a miniscule part of market supply and hence cannot influence the market supply and consequently the price significantly. Similarly, if there is only one firm in the market, it becomes the sole determinant of the market supply and therefore, exercises a great degree of control over the price.

(b) **Ease of Entry and Exit of the Firms:** If the firms can easily enter a particular market or can leave the market without much loss, the price will be stable and profits will be just normal in the long run. In case there are restrictions on entry of new firms, the degree of control of existing firms increases and the possibility of earning higher profits also increases as the firms have a lesser degree of competition in such a case.

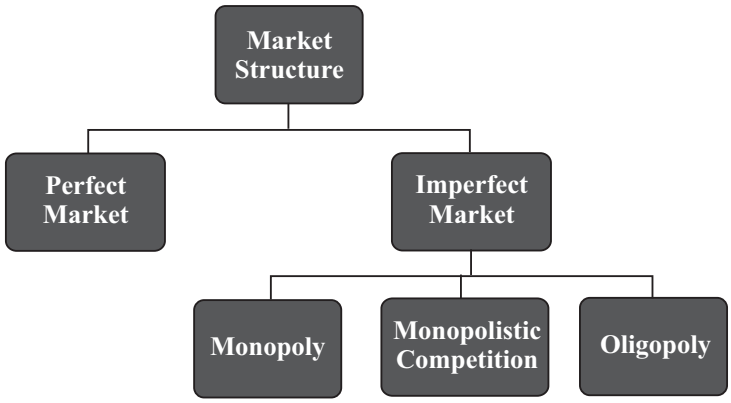
(c) **Degree of Product Differentiation:** It simply means how unique the product offered by a particular firm is. The greater the degree of uniqueness (or higher degree of product differentiation), the greater is the control exercised by that



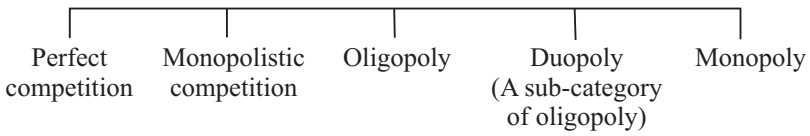
firm over its pricing decisions. In case, the goods offered by different firms are homogeneous, the individual firms lose their control over the market in price determination.

21.3 DIFFERENT FORMS OF MARKET STRUCTURE

Based on the above mentioned characteristics, we can classify different markets in the way as shown in the following chart



On the basis of degree of competition among sellers, we can say that while monopoly does not have any competition, on the otherhand perfect competition has maximum degree of competition. Oligopoly and monopolistic competition lie between these two extreme market forms.



INTEXT QUESTIONS 21.1

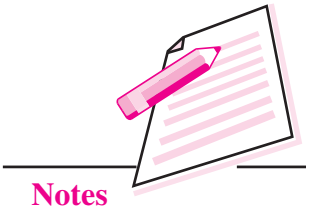
1. What is a market? Explain its salient features.
2. Define market structure?
3. Bring out main features of a market.
4. On what basis, can different market structures be distinguished from one another?
5. Which is the most competitive market structure?
6. Which is the least competitive market structure?
7. Is it necessary for a market to be some specific place?

21.3.1 Perfect Competition

Like any other market structure, Perfect Competition is defined on the basis of its features. Perfect Competition is a market structure in which there is a large number of buyers and sellers who transact homogeneous or similar goods at a price fixed by the market or industry. Here, industry is a group of firms producing similar goods.

Features of Perfect Competition: Perfect Competition is characterized by:

1. **Very Large number of buyers and sellers:** In a perfectly competitive market, there is a very large number of buyers and sellers. For instance, if a single seller tries to raise the price, there is a large number of other sellers selling identical product at a lower price. Therefore, the demand for this particular firm decreases forcing it to come in line again with the industry determined price.
2. **Homogeneous Product:** The products offered by different firms are homogeneous in every respect so that the buyer does not have any basis to prefer the goods of one seller over the goods of another seller. The goods are identical in terms of quality, size, packing, and other terms of deal etc. This feature ensures the uniformity of the price throughout the market.
3. **Firm is a Price Taker:** The firm has to sell the goods at a price determined by the industry as the firm has no control over the price. The market or industry determines this price on the basis of market demand and market supply as shown in the figure. So industry is the price maker and firm is the price taker.
4. **Free Entry and Exit:** Under perfect competition firms are free to enter into the market or exit from the market at any point of time. This means that there is no obstruction from any where for a new firm to produce the same product produced by the existing firms in the market; similarly if a firm wishes to exit then it is free to do so.
5. **Perfect Knowledge:** This feature implies that both sellers and buyers have perfect knowledge about the goods and their prices so that it is not possible for a firm to charge a different price. It also ensures uniform price for the buyers and uniform cost function for the producers.
6. **Perfect Mobility:** The goods as well as the factors of production are perfectly mobile so that there is no restriction- legal or monetary (involving expenditure in movement of goods). This feature ensures that the price throughout the market tends to be uniform.
7. **No Selling Costs:** Selling costs are the costs aimed at promotion of sales of product of a firm, e.g. expenditure on advertisement of a product. In perfect competition, there is no need to incur selling cost because of assumption of



perfect knowledge and homogeneous goods. This implies that if people have complete knowledge about the product, the seller does not find it necessary to educate consumers through advertisements. Similarly, when goods are homogeneous, there is no basis on which the seller can claim superiority of his products over the products of its rivals.

8. **Shape of Demand Curve:** Under perfect competition, the demand curve for the firm is horizontal and perfectly elastic. It means that the firm can sell any amount of the product at the price determined by the industry, but the firm cannot vary the price.

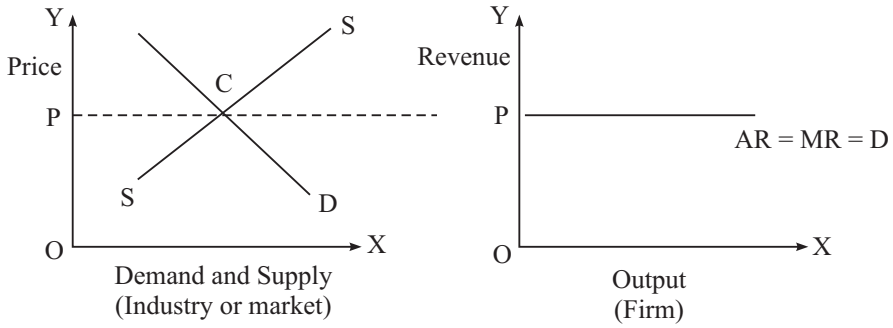


Fig. 21.1

INTEXT QUESTIONS 21.2

1. What is perfect competition? Explain its various features.
2. What is the relevance of the feature of 'large number of buyers and sellers' in perfect competition?
3. Why is there no need of selling cost in perfect competition?
4. What is the shape of demand curve for a product under perfect competition?
5. Why do firms earn only normal profits under perfect competition in the long run?
6. Under perfect competition, firm is a price-taker and not price maker. Explain.
7. Under perfect competition, all the firms sell their goods at the same price. (True/False)

21.3.2 Monopoly

Monopoly is a market structure in which there is a single seller, there are no close substitutes for the commodity produced by the firm and there are barriers to entry.

Example: Indian Railways which is operated under government of India.

Monopoly also implies absence of competition.

Features of Monopoly: Monopoly is characterized by:

1. **Single Seller:** In monopoly, there is only one firm producing the product. The whole industry consists of this single firm. Thus, under monopoly, there is no distinction between firm and industry. Being the only firm, there is significant control of the firm over supply and price. Thus under monopoly, buyers do not have the option of buying the commodity from any other seller. They have to buy the product from the firm or they can go without the commodity. This fact gives immense control to the monopolist over the market.
2. **No Close Substitute:** There are no close substitutes of the product produced by the monopolist firm. If there are close substitutes of the product in the market, it implies presence of more than one firm and hence no nonopoly. In order to ensure a total of control over the market by the monopolist firm, it is assumed that there are no close substitutes of the product.
3. **No to Entry:** Monopoly can only exist when there is strong barriers before a new firm to enter the market. In fact once a monopoly firm starts producing the produt, no other firm can produce the same. One reason for this is the ability of the monopolist to produce the product at a lower cost than any new firm who thinks to enter the market. If a new firm who knows that it can not produce at a lower cost than the monopolist, then the that firm will never enter the market for fear of loosing out in competition. Similarly the monopolist who is operating for a long time may be enjoying reputation among its customers and is in a better position to use the situation in its own benefit. A new firm has to take long time to achieve this and so may not be interested to enter the market.
4. **Price Maker:** Being the single seller of the product, the monopolist has full control over the pricing of the product. On the other hand, if there is a large number of buyers in the market, so no single buyer exercises any significant influence over price determination. Thus, it is a seller's market. So monopoly firm is a price maker.
5. **Price Discrimination:** Having considerable control over the market on account of being single seller with no entry of other firms, the monopolist can exercise policy of price discrimination, it means that the monopolist can sell different quantities of the same product to a consumer at different price or same quantity to different consumers at different prices by adjudging the standard of living of the consumer.

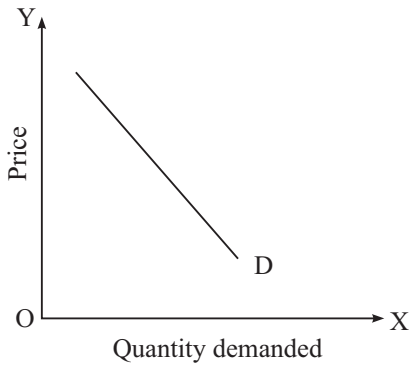
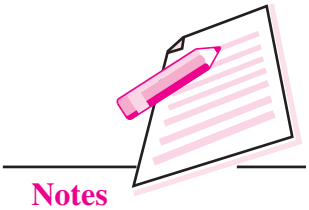


Fig. 21.2



6. **Shape of Demand Curve:** Since a monopolist has full control over the price, therefore, he can sell more by lowering the price. This makes the demand curve downward sloping. As there is no competition of the firm in the market, demand curve is in elastic. See figure 2.

INTEXT QUESTIONS 21.3

1. What is monopoly? Explain its features.
2. Draw a comparison between perfect competition and monopoly.
3. In what forms, can there be barriers to entry of other firms? What role do these barriers play?
4. Why do we assume that there are no close substitutes of the goods produced by a monopolist?
5. What kind of profits are earned by a monopolist in the long run and why?
6. Define price discrimination.
7. Under monopoly, firm is price taker. (True/False)

21.3.3 Monopolistic Competition

Monopolistic Competition is a market structure in which there is a large number of sellers in the market of a commodity, but the product of each seller differs in some respect from the product of the other sellers. Thus, product differentiation is the cornerstone of Monopolistic Competition. Monopolistic competition is like an amalgam of monopoly and perfect competition, and hence the name Monopolistic Competition. According to J.S. Bains, "Monopolistic Competition is a market structure where there is a large number of sellers, selling differentiated but close substitute products."

Example: Restaurants, Market for Toothpaste etc.

Features of Monopolistic Competition

Monopolistic Competition is characterized by:

1. **Large number of firms:** Under monopolistic competition, there is a large number of firms selling closely related products. Thus the control of a particular firm is somewhat diminished when compared to that of monopoly.
2. **Product Differentiation:** Product Differentiation is a very important feature of Monopolistic Competition. This differentiation could be on the basis of quality, packaging, colour etc. or this differentiation could also be just a matter of perception.

   For example: You must have seen different brands of tooth paste. Even if they look different having different taste, the produt it has same use.

3. **Selling Costs:** Under monopolistic competition firms spend a lot on advertisement of their product in order to attract the customers and sell their product. Every firm tries to promote its product through advertisement for which it bears some extra cost ove and above its cost of production. This is calle selling cost.

4. **Non-Price Competition:** Under Monopolistic Competition, sometimes, firms compete with each other without changing price. They may start various promotion schemes, gift schemes or compete in terms of advertisement etc. Thus, firms compete under in every possible way to attract consumers and gain maximum possible market share.

5. **Nature of Demand Curve:** Like monopoly, Monopolistic Competition also has a downward sloping demand curve. However due to the existence of competitors in the market, the degree of steepness of the curve is little less, reflecting greater price elasticity of demand and less control of the firm than that of monopoly. (see figure 21.3).

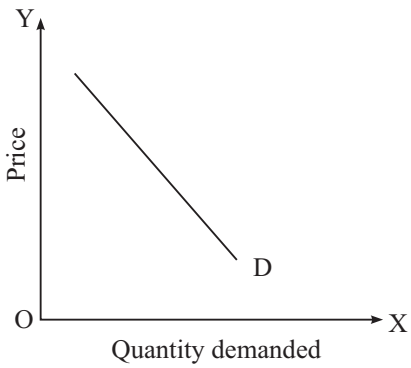


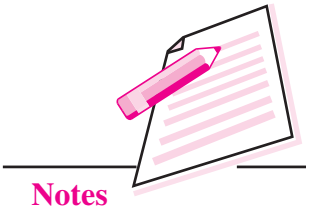
Fig. 21.3

INTEXT QUESTIONS 23.4

1. Define monopolistic competition. Explain its features
2. Draw comparison between perfect competition and Monopolistic competition.
3. Draw comparison between monopoly and monopolistic competition.
4. Explain product differentiation under monopolistic competition.
5. Monopolistic competition is an amalgam of monopoly and perfect competition. Explain.
6. Explain 'Non-price competition'.
7. Fill in the blanks with appropriate words:
   (i) Under monopolistic competition, the number of firms is .....
   (ii) Demand curve under monopolistic competition is ..... sloping.
   (iii) Product differentiation is the cornerstone of .....

21.3.4 Oligopoly

Oligopoly is an important form of imperfect competition. Oligopoly exists when there are few firms selling the product. W.H. Fellner wrote a book on oligopoly



with the title, "Competition among the Few". This title aptly summarizes what oligopoly is. Oligopoly can simply be defined as the competition among the few firms. The products of these firms may either be close substitutes or homogeneous.

Example: Mobile service providers, car industry, airlines etc.

A. Features of Oligopoly

Oligopoly is characterized by following features:

1. **Interdependence:** Interdependence is a very significant feature of Oligopoly. When the number of firms is small, any strategy regarding change in price, output or quality of a product, will depend on the rival's reaction for its success. Thus, the success of price reduction policy by one company (say, Pepsi) will depend on reaction by its rival (say, Coke). For example, if Pepsi lowers the price per bottle from Rs 10 to Rs 8, the effect of this step on demand for Pepsi will depend on the counter-strategy of Coke. If Coke decides to follow price war strategy and lowers price from Rs 10 per bottle to Rs 7 per bottle, demand for Pepsi may decrease even below its initial level.

2. **Indeterminate Demand Curve:** Demand curve presents different quantities of a product demanded at various prices. However, demand for a product at different prices can be known only when rivals' counter strategies can be predicted with certainty. This being not possible, we cannot draw the usual demand curve for the firm's product in case of oligopoly.

3. **Selling Costs:** Oligopoly firms bear selling cost such as advertisement, sales promotion etc. to sale the product.

4. **Group Behaviour:** Since there are a few firms under oligopoly, there is a tendency among them to come together in order to avoid competition. They may meet secretly to negotiate price and quantity in the market. The aim is to maximise profit in the same manner as a monopolist does. Obviously when they come together it looks as if all firms have become a single entity like a monopolist. But such groupism is done secretly as the government may take action if it comes to know about this type of group behaviours of firm where in firms are trying to reduce competition among them selves. Note that when firms form a group secretly to share profit or quantity etc. it is called collusive oligopoly. When firms work independently and compete with each other, it is called non-collusive oligopoly.

5. **Price Rigidity:** In oligopoly market, once the price of the produt is fixed by the firms, it is normally not changiable. So price is rigid. The reasons for this is that firms face different types of consumers having different elasticities of

demand. So response of change in quantity due to change in price many vary from one firm to another creating uncertainty about future sales. So fearing this firms do not change price once its is fixed.

B. Types of Oligopoly

Oligopoly may further be classified into collusive oligopoly and non-collusive oligopoly.

(a) Collusive oligopoly

The firms under oligopoly may decide to co-operate with each other and make common policies for all the firms. Thus, firms may collude with each other work on common pricing policies and make common output decisions. In such an environment, the group of firms can behave like a monopolist and earn supernormal profits. This group of colluding firms is called 'cartel'. One prominent example of cartel is 'the Organization of Petroleum Exporting Countries (PEC)'.

(b) Non-collusive oligopoly

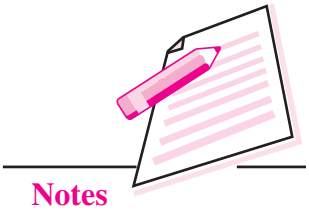
When firms do not co-operate with each other and engage in fierce competition with each other, the market is called non-collusive oligopoly. Under such environment, while competing with each other, firms drive price levels, and profit levels down to the level of normal profit only.

INTEXT QUESTIONS 21.5

1. What is oligopoly? Explain its features.
2. Define oligopoly. Give example.
3. Explain nature of demand curve under oligopoly.
4. 'Interdependence' and 'Group Behaviour' are two very important features of oligopoly. Comment.
5. What is collusive oligopoly?
6. What is non-collusive oligopoly?

TERMINAL EXERCISE

1. Define a market. What are different types of market?
2. What is Perfect Competition ? Explain its features briefly.
3. What is Monopoly ? Explain its features briefly.
4. What is Monopolistic Competition ? Explain its features briefly.



5. Fill in the blanks:
   (a) Price determination by industry is a feature of .....
   (b) Under Oligopoly, price tends to be .....
   (c) In Monopoly, the number of firms is .....
   (d) Product Differentiation is the corner stone of .....
   (e) Interdependence is the most important feature of
   (f) Market is a place, a particular geographical location. (True/False)

ANSWERS TO INTEXT QUESTIONS

21.1

1. Refer to 21.2
2. Refer to 21.3
3. Refer to 21.2
4. Refer to 21.3
5. Perfect competition
6. Monopoly
7. No

21.2

1. Refer to 21.3.1
2. Refer to 21.3.1 pt. 1
3. Refer to 21.3.1 pt. 7
4. Refer to 21.3.1 pt. 2
5. Refer to 21.3.1 pt. 4
6. Refer to 21.3.1 pt. 2
7. True

21.3

1. Refer to 21.3.2
2. Refer to 21.3.1 and 21.3.2
3. Refer to 21.3.2 point No. 3
4. Refer to 21.3.2 point No. 2
5. Refer to 21.3.2 point No. 3

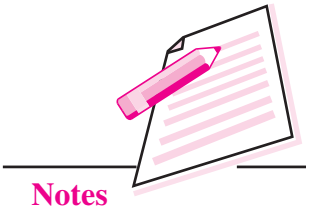
6. Refer to 21.3.2 point No. 6
7. False

21.4

1. Refer to 21.3.3
2. Refer to 21.3.1 and 21.3.3
3. Refer to 21.2 and 21.3
4. Refer to 21.3.3 point No. 2
5. Refer to 21.3.3
6. Refer to 21.3.3 point No. 4
7. (i) large
   (ii) downward
   (iii) monopolistic competition

21.5

1. Refer to 21.3.4 and 21.4.4 (A)
2. Refer to 21.3.4 (A)
3. Refer to 21.3.4 (A) point No. 2 and 6
4. Refer to 21.3.4 (A) point No. 1 and 4
5. Refer to 21.3.4 (B) part (a)
6. Refer to 21.3.4 (B) part (b)



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PRICE DETERMINATION UNDER PERFECT COMPETITION

One of the objectives of firm and industry is to maximize profit. As an alternative, the firm also wants to minimize loss. Whatever it may be, a firm must determine the price and quantity that will ensure achieving these goals. The manner in which a firm/industry determines the price and output depends on the market form in which it is operating. In the preceeding lesson, you learnt that there are various forms of market in which a firm or industry operate. This lesson is devoted towards determination of price and quantity by the industry and a firm under the market form or perfect competition.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning of equilibrium price;
- explain the process by which the twin market forces of demand and supply determine the equilibrium market price of a commodity under perfect competition;
- explain the concepts of excess demand and excess supply;
- identify the effects of change in demand and/or supply on equilibrium price and quantity; and
- understand the process of price determination of a competitive firm.

22.1 MEANING OF EQUILIBRIUM PRICE

Equilibrium means a position from which there is no tendency to change.

Prof. Marshall compared demand and supply to the two blades of a pair of scissors. A moment of reflection will show that it is not blade alone that cuts the cloth. Both the blades together, do it. Similarly, it is not demand or supply alone that determines the price of a commodity. Together through interaction they determine the equilibrium price of a commodity.

The forces of demand and supply determine the price of a commodity. There is a conflict in the aim of producers and consumers. Producers want to sell the goods at the highest price to maximize profit and consumers want to buy the goods at the lowest price to maximize satisfaction.

Equilibrium price will be determined where quantity demanded is equal to quantity supplied in the market. This is called market equilibrium price of the commodity.

Industry Demand and Supply Under Perfect Competition

In lesson 21, you have learnt that the industry under perfect competition is defined as the collection of Large number of firms producing the homogeneous product. In such a situation no firm enjoys any power to determine its own price. The price of the commodity is determined at the level of the industry through the interaction of the forces of demand and supply of the commodity in the market. Since industry is the price maker, the industry demand curve is downward sloping (same as the market demand for a product given in lesson 15). Similarly the industry supply curve of the product is an upward sloping curve (same as the market supply curve given lesson 19).

22.2 PROCESS OF ARRIVING AT EQUILIBRIUM PRICE

Consider the following schedule 22.1 showing market demand and market supply of good X are given..

Table 22.1 Determination of Equilibrium Price of good X.

Price (₹ Per kg)	Market Demand (kg)	Market Supply (kg)
6	16	24
5	18	22
4	20	20
3	22	18
2	24	16

Let us assume that the initial price is ₹ 6 per kg and the respective levels of quantity demanded and supplied are 16 and 24 kg respectively. Obviously, quantity supplied at this price is exceeding quantity demanded. So, the suppliers or producers will offer a lower price to the buyers to ensure that their goods do not remain unsold. So, the price gradually moves from ₹ 6 to ₹ 5 per kg. At this relatively lower price, demand expands to 18 kg while supply contracts to 22 kg (in accordance with the respective laws of demand and supply), but still there is a gap between supply and demand. So the suppliers still feel that all of their goods might not sell in the market as quantity demanded is less than quantity supplied. So, they reduce price further so as to ensure that their goods do not remain unsold. This process continues till the price level reaches a point where quantity demanded equals quantity supplied. Thus, when the price falls from ₹ 5 to ₹ 4, quantity demanded as well as quantity supplied is equal to 20 kg. Now the suppliers have no reason to reduce their price further. Hence as long as quantity supplied exceeds the quantity demanded, price of the commodity keeps falling till both become equal.

Note that, when supply exceeds demand, we call it excess supply that causes price to fall till demand and supply become equal to each other.

On the otherhand, at a very low price of ₹ 2, quantity demanded in 24 kg which is higher than quntity supplied of 16 kg. Since demand is higher then supply, price of the commodity increases to ₹ 3. At ₹ 3, the quantity demanded is 22 kg which is still higher than the quantity supplied of 18 kg. This further results in increase in price to ₹ 4 where we find that quantity demanded and supplied have become equal at 20 kg.

Hence as long as quantity demanded exceeds the quantity supplied, the price of the commodity keeps increasing till both demand and supply become equal to each other.

Note that when demand exceeds supply, we call it excess demand that causes price to rise till demand equals supply.

In the example, at ₹ 4, demand and supply of the commodity are equal and hence there is no reason for the price to fluctuate from here. Hence ₹ 4 is the equilibrium market price. At this price 20 kg is equilibrium quantity.

The process of price determination has also been explained with the help of figure 22.1. In the figure, DD is the demand curve and SS is the supply curve. The negative slope of demand curve DD indicates a negative relation between price of

the commodity and its quantity demanded. Similarly, positive slope of the supply curve SS indicates a positive relation between price of the commodity and its quantity supplied. Demand curve DD and supply curve SS intersect each other at point E, which is the point of equilibrium at which equilibrium price is ₹ 4 per kg. and equilibrium quantity demanded and supplied is 20 kg. Equilibrium price is also defined as the price at which demand curve and supply curve intersect each other. (alternatively, equilibrium price is the price at which quantity demanded of a commodity equals its quantity supplied).

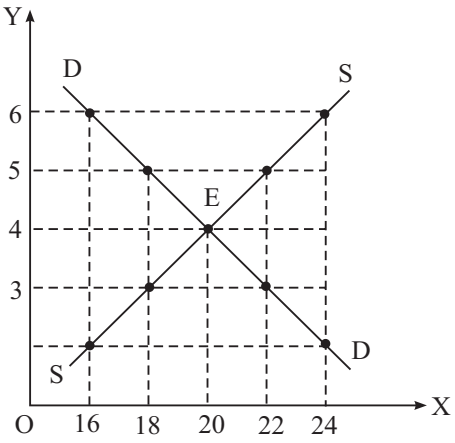


Fig. 22.1

Price Determination for a Firm under Perfect Competition

Under perfect competition, the industry determines the price following the same route of adjustment as described above with the help of twin market forces of demand and supply. Firms have to accept the price determined by the industry and offer their output at this price. This canbe shown with the help of the following figure.

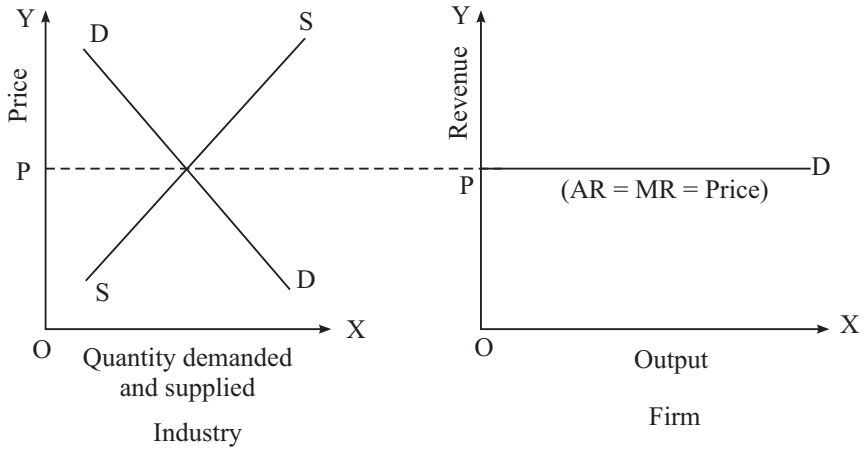
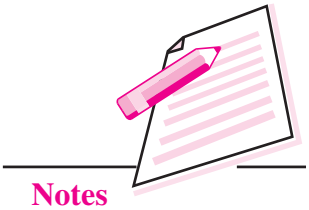


Fig. 22.2



Industry		Firm					
Price (₹ per kg)	Quantity Demanded (kg)	Quantity Supplied (kg)	Price (₹ per kg)	Quantity Supplied	TR (P×Q)	AR AR = P	MR
2	20	12	4	0	0	4	–
3	18	14	4	1	4	4	4
4	16	16	4	2	8	4	4
5	14	18	4	3	12	4	4
6	12	20	4	4	16	4	4

Under perfect jcompetition at price ₹ 4 per kg industry demand and industry supply are both equal to 16 kg and hence the equilibrium price determined by the industry is ₹ 4 per kg which has to be followed by all the firms of the industry. The firm may sell any quantity but the price remains constant at ₹ 4 per kg. That is why AR = MR in perfect competitioin, and are represented by a revenue curve which is parallel to x-axis.

INTEXT QUESTIONS 22.1

1. Define equilibrium price.
2. Which force of price determination is relatively more important and why?
3. Can we have two levels of equilibrium price for demand curve DD and supply curve SS? Support your answer with reason.
4. Tick the correct answer:
   (i) Point of intersection of demand curve and supply curve shows:
      (a) The equilibrium price
      (b) The equilibrium quantity
      (c) Neither of the two
      (d) Both equilibrium price and quantity
   (ii) Equilibrium price of a commodity is the price at which
      (a) Quantity demanded and supplied, both rise
      (b) Supply is maximum'
      (c) Demand is maximum
      (d) Quantity demanded and supplied are equal.

(iii) Equilibrium means

(a) The variables are changing continuously

(b) Demand and supply are unequal

(c) The variables show no tendency to change

(d) None of the above

(iv) If at some particular price, the quantity demanded exceeds its quantity supplied, then

(a) Price will rise

(b) Demand will fall

(c) Supply will increase

(d) All of the above

Let us now explain the excess demand and excess supply situation by using diagrams.

22.3 EXCESS DEMAND

Excess Demand is the gap between demand and supply when demand is more than supply. If at a given price, the quantity demanded of a commodity exceeds its quantity supplied we have excess demand. For example, in the table 22.1, when price is ₹ 2 per kg., demand is 24 kg. while supply is just 16 kg. So this is a situation of excess demand.

Process of Adjustment

One very interesting and important feature of price mechanism is that any disequilibrium is self-correcting. Thus if there is excess demand at any price, price will move in such a way so as to bring equilibrium between demand and supply. In Fig. 22.1, when price is ₹ 2, quantity demanded is 24 kg but quantity supplied is just 16 kg. So there is excess demand of 24 – 16 = 8 kg. In this situation, buyers realize that some of them will have to go without the commodity as supply is less than that of demand. So they compete to buy the product and in the process, offer a higher price. So, effectively price moves from ₹ 2 to ₹ 3 per kg. At this relatively higher price, demand contracts from 24 kg to 22 kg and supply expands from 16 to 18 kg. So, the magnitude of excess demand has diminished from 8 kg to 4 kg, but still there is a gap and some of the buyers have still to go without the commodity. So there is still competition, which raises the price further to ₹ 4 per kg, where demand contracts further to 20 kg and supply expands to 20 kg. Now, both quantity demanded and quantity supplied are equal.

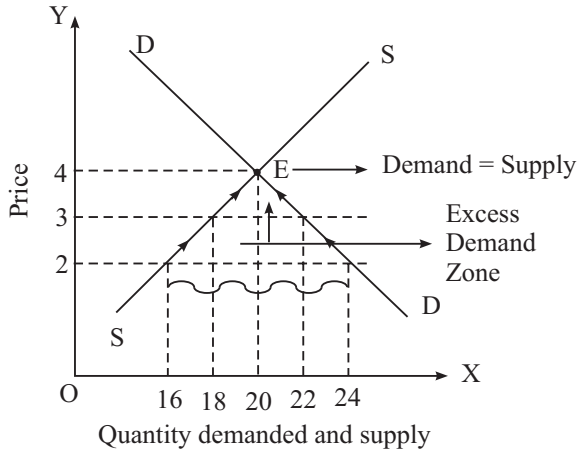


Fig. 22.3

So, the equilibrium has been brought about by increase in price, which also contracts demand and expands supply. We can summarize the process as follows:

(a) In case of excess demand, price starts rising, as the buyers try to compete out each other.

(b) As a result of rise in price, demand starts contracting and supply starts expanding.

(c) All these movements of price, demand and supply result in getting equilibrium restored, though at a higher price, than before.

22.4 EXCESS SUPPLY

Excess Supply is the gap between demand and supply when Supply is more than demand. If at a given price, the quantity supplied of a commodity exceeds its quantity demanded we have excess Supply. For example, in the table 22.1, when price is ₹ 6 per kg., demand is 16 kg. while supply is just 24 kg., obviously this is a situation of excess Supply.

Process of Adjustment

When quantity supplied is more than quantity demanded at price of ₹ 6 per kg., the suppliers are now worried as they know that because of excess supply, all of their goods might not be sold. Every supplier now wants to ensure that his goods are not left unsold. In a bid to ensure this, the supplier, tries to lure consumers by lowering the price to ₹ 5 per kg. But other suppliers are also doing precisely the same. So, the price effectively falls to ₹ 5 per kg. But even at this relatively lower price, supply still exceeds demand by 4 kg. and so another cycle of offering a lower

price starts. This continues till the price reaches the level of ₹ 4 per kg where quantity demanded equals quantity supplied. At this price, suppliers have no reason to offer a lower price, as they know that at this price all their goods are going to be sold. So the equilibrium in this case has been brought about by decrease in price, which also contracts supply and expands demand.

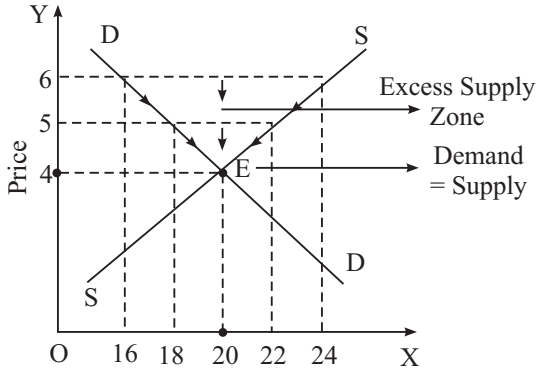


Fig. 22.4

We can summarize the process as follows:

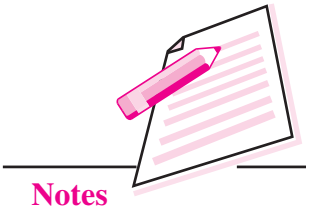
(a) In case of excess supply, price starts falling, as the suppliers try to compete out each other.

(b) As a result of fall in price, demand starts expanding and supply starts contracting.

(c) All these movements of price, demand and supply result in getting equilibrium restored, though at a lower price, than before.

INTEXT QUESTIONS 22.2

1. What is excess demand?
2. What is excess supply?
3. How is equilibrium between demand and supply restored in case of excess demand?
4. How is equilibrium between demand and supply restored in case of excess supply?
5. Explain the effect of adjustment process on price, demand and supply in case of excess demand?
6. Explain the effect of adjustment process on price, demand and supply in case of excess supply?



22.5 EFFECT OF CHANGE IN DEMAND ON EQUILIBRIUM PRICE AND QUANTITY

As demand and supply are the twin forces determining the equilibrium price of a commodity, any change in either or both of them is bound to bring in some change in price. We will study, in this section, the effect of change in demand, supply held constant.

(i) Effect of Increase in demand

When due to any external factor such as rise in population, rise in income of people, demand for a commodity increases (for every price level), the demand curve shifts rightwards. As a result, it now intersects the supply curve at a new, higher level, which causes the price to rise. As shown in the figure below, initial demand curve DD intersects supply curve SS at point e.

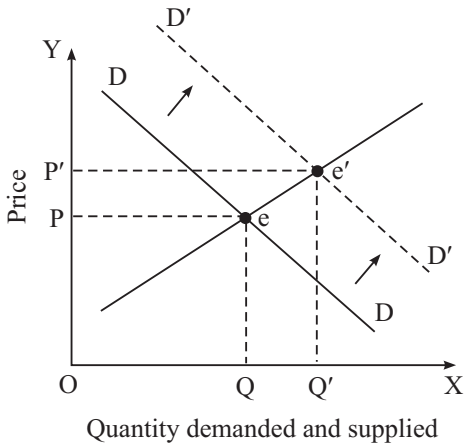


Fig. 22.5

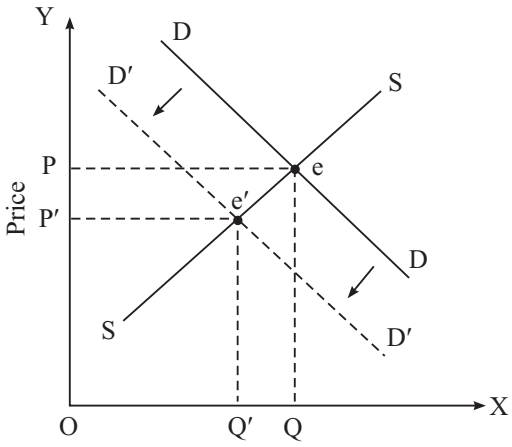
The equilibrium price is OP and the equilibrium quantity demanded and supplied are OQ. Now, suppose demand increases and as a result, demand curve shifts rightwards. This new demand curve D'D' intersects the supply curve SS at pointt e'. So, the new equilibrium price is OP' which is higher than the earlier. price OP. It may also be noted that the equilibrium quantity demanded and supplied have also risen from OQ to OQ'.

(ii) Effect of Decrease in Demand

When due to any external event such as fall in income level, demand for a commodity falls, the demand curve shifts leftwards. So, this new demand curve intersects supply curve at a lower level which causes the price to fall. As shown in

the figure 22.8, initial demand curve DD intersects the supply curve SS at point e.

The equilibrium price is OP and the equilibrium, quantity demaned and supplied are OQ. Now, suppose demand decreases and as a result, demand curve shift leftwards. This new demand curve D'D' intersects the supply curve SS at point e'. So, the new equilibrium price is OP' which is lower than the earlier price OP. It may also be noted that the equilibrium quantity demanded and supplied have also decreased from OQ to OQ'.



Quantity demanded and supplied

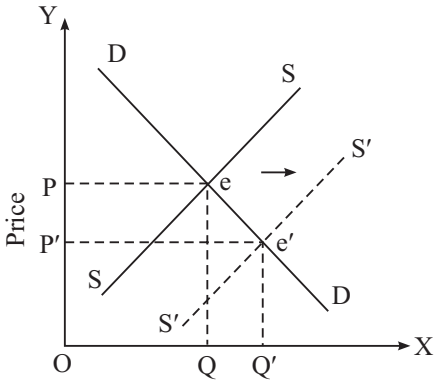
Fig. 22.6

22.6 EFFECT OF CHANGE IN SUPPLY ON EQUILIBRIUM PRICE AND QUANTITY

In this case, we will show the impact of change in supply of the commodity while demand for it remains the same.

(i) Effect of Increase in Supply

When due to any external factor such as a bumper crop, supply of a commodity increases (for every price level), the supply curve shifts rightwards. As a result, it now intersects the demand curve at a new, lower level, which causes the price to fall. As shown in the figure 24.9, demand curve DD intersects the initial supply curve SS at point e.



Quantity demanded and supplied

Fig. 22.7

The equilibrium price is OP and the equilibrium quantity demanded and supplied are OQ. Now, suppose, supply increases and as a result, supply curve shifts rightwards. This new supply curve S'S' intersects demand curve DD at point e'. So, the new equilibrium price is OP' which is higher than the earlier price OP. It may also be noted that the equilibrium quantity demanded and supplied have fallen from OQ to OQ'.

(ii) Effect of Decrease in Supply

When due to any external event such as paucity of raw material or say, floods or drought, supply for a commodity falls, the supply curve shifts leftwards. So, this new supply curve intersects demand curve at a higher level which causes the price to rise. As shown in the figure 22.10 demand curve DD intersects the initial supply curve SS at point e.

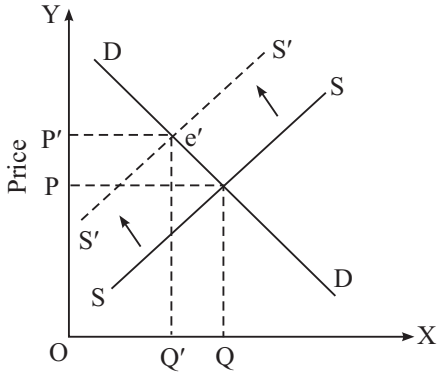


Fig. 22.8

The equilibrium price is OP and the equilibrium quantity demanded and supplied are OQ. Now, suppose supply decreases and as a result, supply curve shifts leftwards. This new supply curve S'S' intersects the demand curve DD at point e'. So the new equilibrium price is OP' which is higher than the earlier price OP. It may also be noted that the equilibrium quantity demanded and supplied have also decreased from OQ to OQ'.

22.7 EFFECT OF SIMULTANEOUS CHANGE IN DEMAND AND SUPPLY ON EQUILIBRIUM PRICE AND QUANTITY

Effect of any change in demand and supply will lead to a resultant change on equilibrium price. The direction of change in price will depend on relative strength

of change in demand and supply. For example, if both supply and demand increase and increase in demand is greater than increase in supply, price will rise. Any kind of change in demand and supply and their effect on price can be shown by drawing relevant demand and supply curves. A few cases are given here.

Increase in Both Demand and Supply

The three possible cases when both demand and supply are increasing can be explained as follows:

(a) Increase in Demand = Increase in Supply

The upward effect of increase in demand on price equals downward effect of increase in supply. As both the forces are equal in magnitude, price level remains the same. This is shown in the figure 22.11.

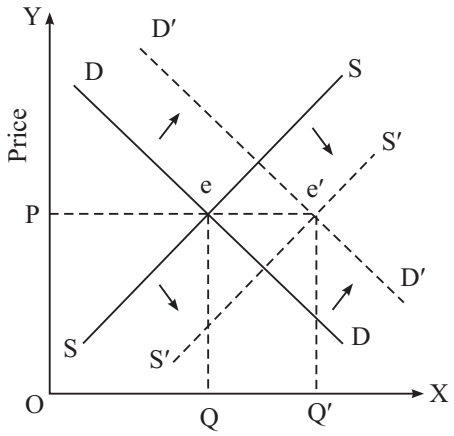
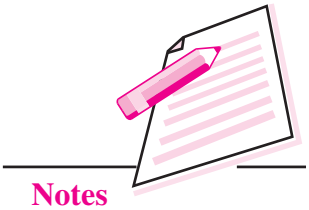


Fig. 22.9

(b) Increase in Demand > Increase in Supply

As in this case, the upward effect of increase in demand on price is greater than that of downward effect of increase in supply. As a result, price level rises. This is shown in the figure 22.12.



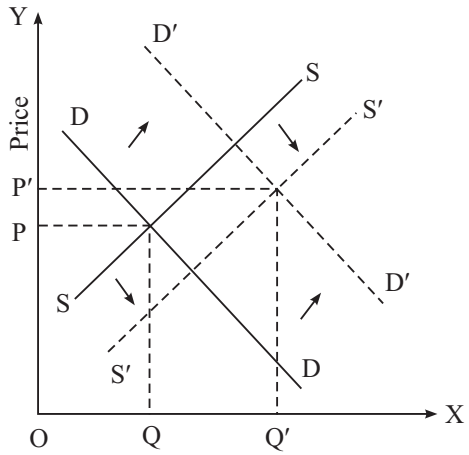


Fig. 22.10

(c) Increase in Demand < Increase in Supply

In this case, the upward effect of increase in demand on price is less than that of downward effect of increase in supply. As a result, price level falls. This is shown in the figure 22.13.

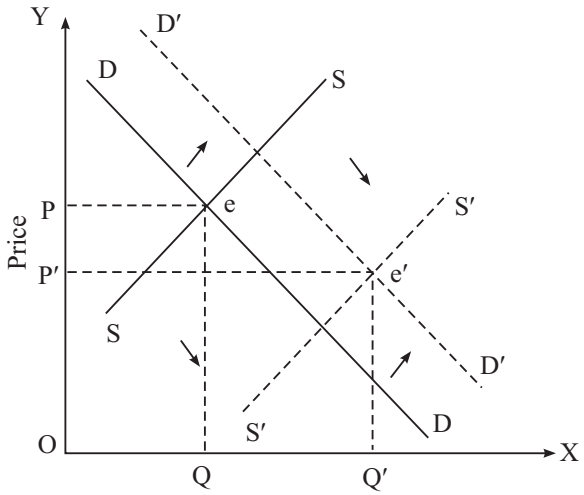


Fig. 22.11

Some other Cases

Similarly, we may conceive of many more other cases of change in demand and supply. A simultaneous decrease in both of them with three possibilities as described above or decrease in one of them and increase in the other again the magnitude of decrease or increase affecting the price and quantities change in demand and supply

with their different elasticities and so on. The possibilities may be numerous but the method to arrive at the equilibrium price remains essentially the same.

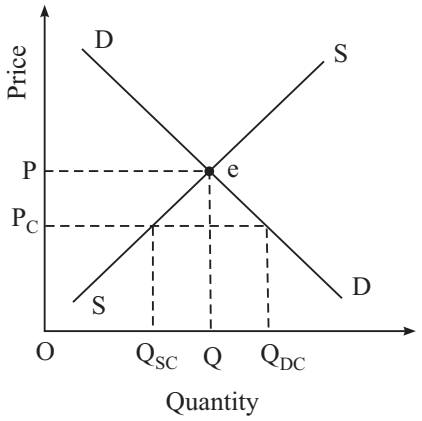
INTEXT QUESTIONS 22.3

1. With the help of diagrams, show the effect of increase and decrease in demand on price when supply remains constant.
2. With the help of diagrams, show the effect of increase and decrease in supply on price when demand remains constant.
3. Show the effect of increase in supply on price of a commodity when its demand is perfectly elastic.
4. Show the effect of simultaneous decrease in demand and supply on price when supply changes relatively to a greater extent.

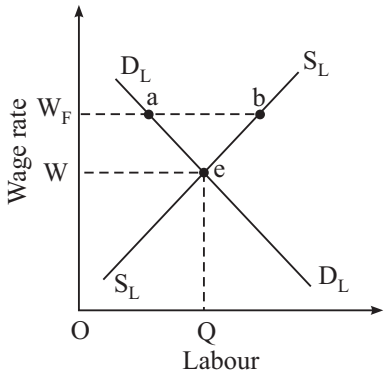
22.8 SIMPLE APPLICATION OF DEMAND AND SUPPLY ANALYSIS

Determination of equilibrium price finds many applications in daily life and has implications for formulation of policies by the government. For example, formation of policies regarding floor price and ceiling price can be explained with the help of equilibrium price.

(a) Ceiling price: When the price prevailing in the market is too high and is affecting the interests of the consumers adversely, the government has to step in and decide ceiling price. The sellers are not allowed to raise price of their products beyond this ceiling price and thus the interests of the consumers are protected. An example of this may be rent control policy. Suppose the current rent for a particular type of flats is determined at OP which is exorbitant. In such a case, the government can fix the rent arbitrarily at OPc which is lower then OP and will give some relief to tenants (consumers). It may be mentioned that at this controlled rent OPc, the demand for flats (OQ_{DC}) exceeds supply of flats (OQ_{SC}) and this may lead to unscrupulous practices for which the government may have to take preventive and remedial measures. It may also be mentioned that fixation of price at a level above OP has no point as price mechanism will automatically push the price level back to OP.



(b) Floor Price: It is not necessary that price determined is always too high. Sometimes it may be too low also. It may happen especially in markets with excessive supply of something. For example, Indian labour market is a market with excessive supply of labour. In such a setting, the wage rate determined by the market forces of demand and supply is generally too low (especially in the market for unskilled labour). To protect workers' interests in such a case the government may pass minimum wage legislation. Suppose, the wage rate prevailing in the market is OW which is too low. The government may pass minimum wage legislation and fix minimum wages at OW_F. This minimum wage level is floor price. The government does not allow the price level to go lower than floor price and thus sellers' interests are protected. (worker is the seller of his labour).



INTEXT QUESTIONS 22.4

1. What is ceiling price?
2. What is floor price?
3. What is the need for minimum wage legislation?
4. Explain ceiling price with the help of graph.
5. Define equilibrium price?

WHAT YOU HAVE LEARNT

- Equilibrium price is the price at which market demand for a commodity equals it market supply.
- Equilibrium price is determined by the interaction of the forces of demand and supply of a commodity. The point of intersection of demand curves and supply curve is called 'Equilibrium point' and the price and quantity determined at this point are called 'equilibrium price' and 'equilibrium quantity'.
- The property of flexibility ensures that any disequilibrium in demand and supply is self correcting through movement of price.

- Excess demand means more demand than supply at a given price.
- Excess supply means more supply than demand at a given price.
- With rise/fall in demand for a commodity, for a given supply both equilibrium price and quantity will rise/fall.
- With rise/fall in supply of a commodity for a given demand, both equilibrium price and quantity will fall/rise.
- When both demand and supply increase or decrease, their effect on equilibrium price and quantity depends on relative magnitude of change in demand and supply.
- Ceiling price is the price fixed below equilibrium price to protect consumers' interests. The government does not allow the price to mover above the ceiling price.
- Floor price is the price fixed above equilibrium price to protect sellers' interests. The government does not allow the price to fall below the floor price. Minimum wage legislation is an example.

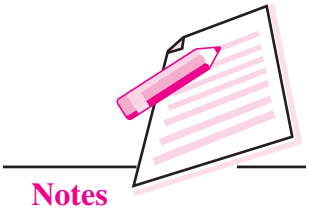
TERMINAL EXERCISE

1. What is equilibrium price? Explain with the help of diagram.
2. What is excess demand? How is equilibrium between demand and supply restored in case of excess demand?
3. What is excess supply? How is equilibrium between demand and supply restored in case of excess supply?
4. Explain the effect of simultaneous increase in demand and increase in supply on equilibrium price and quantity. Use relevant diagrams.
5. Market demand and supply schedule of a commodity is given below:

Price (Rs per kg)	Quantity demanded (kg)	Quantity supplied (kg)
2	20	12
3	18	14
4	16	16
5	14	18
6	12	20

(i) What is the equilibrium price of the commodity?

(ii) What is the equilibrium quantity demanded and supplied at this price?



(iii) What happens if initial price is Rs 2 per kg?

(iv) What happens if initial price is Rs 6 per kg?

6. Explain the concept of ceiling price and floor price.

ANSWER TO INTEXT QUESTIONS

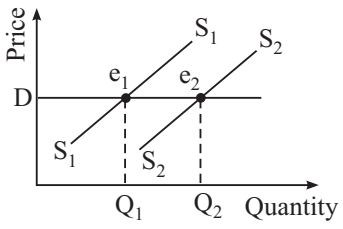
22.1

1. Refer to 22.1
2. Refer to 22.1
3. Refer to 22.2
4. (i) (d)
   (ii) (d)
   (iii) (c)
   (iv) (d)

22.2

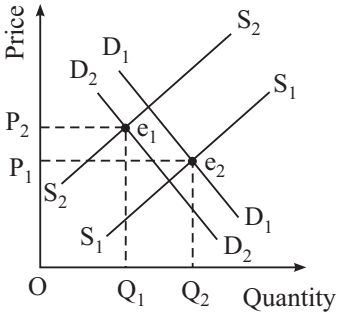
1. Refer to 22.3
2. Refer to 22.4
3. Refer to 22.3 (Process of Adjustment)
4. Refer to 22.4 (Process of Adjustment)
5. Refer to 22.3
6. Refer to 22.4

22.3

1. Refer to 22.5
2. Refer to 22.6
3. 

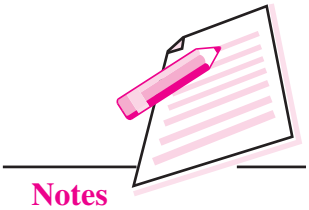
So price remains the same, whereas quantity rises.

4. As a result of shift in demand curve from D_1D_1 to D_2D_2 and supply curve from S_1S_1 to S_2S_2, the equilibrium point moves from e_1 to e_2. (Note that the magnitude of shift is greater for supply curve). consequently, equilibrium price increases from p_1 to p_2 which equilibrium quantity falls from Q_1 to Q_2.



22.4

1. Refer to 22.8(a)
2. Refer to 22.8(b)
3. Refer to 22.8(b)
4. Refer to 22.8(a)



23

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REVENUE AND PROFIT MAXIMIZATION OF A COMPETITIVE FIRM

Every producer/firm wants to get money by selling the product it has produced. Revenue or turnover is money that a firm/producer receives from its normal business activities, usually from the sale of goods and services to customers. The firm wants to recover its cost of production from the revenue it earns. In fact the firm wants to create simply of revenue over cost as well. How does a competitive firm achieve its goal of profit maximization is the topic of discussion here. The analysis is only meant for a competitive firm.

OBJECTIVES

After completing this lesson, you will be able to:

- understand the concept of total revenue (TR); average revenue (AR) and marginal revenue (MR);
- distinguish between super normal profit, normal profit, and loss; and
- explain producers equilibrium of a competitive firm by using TR and TC approach as well MR and MC approach.

23.1 CONCEPT OF REVENUE

Revenue (sometimes called sales) refers to all the money a Firm/producer takes in from doing what it does – whether making goods or providing services. Total revenue of a firm is defined as the total sales proceeds in the market. The firm sales different quantities of the product to its customers at the prevailing market price. So the total revenue can be calculated by multiplying price with quantity. Symbolically

$$TR = PXQ$$

where TR = Total revenue

P = Price

Q = Quantity.

Average Revenue (AR)

AR is defined as the ratio of total revenue to quantity of the product. Symbolically,

$$AR = \frac{TR}{Q}$$

Put $TR = P \times Q$

i.e. $AR = \frac{P \times Q}{Q}$

or $AR = P$

Average revenue is also known as the price of the product. In other words AR is the revenue per unit of the product sold by the firm.

Marginal revenue (MR)

Marginal revenue is defined as the increase in the total revenue due to an extra unit of the commodity sold by the firm in the market. In other worlds *MR* is the addition to *TR* as a result of the additional unit of the good sold. Symbolically,

$$MR = \frac{\Delta TR}{\Delta Q}$$

where Δ stands for change in.

Under perfect competition (refer to Lesson 22- "Forms of Market"), the price of the product is given as the product is homogeneous. So the *TR* of a firm can increase or decrease depending on the quantity it sells. If the quantity decreases *TR* will decrease and if quantity increases *TR* will also increase. See the Table below to know the behaviour of *TR* of a firm under perfect competition.

Table 23.1: TR, AR and MR of a competitive Firm

Price	Quantity	*TR*	*MR*	*AR*
10	0	0	0	0
10	1	10	10	10
10	2	20	10	10
10	3	30	10	10
10	4	40	10	10

As given in the table the price of the commodity is given at ` 10. It remains at 10 whatever quantity is sold. Now when quantity is 1, TR = 10 × 1 = 10. When quantity increase to 2, TR = 10 × 2 = 20. When quantity further increases to 3 and 4, TR increases to 30 and 40 respectively. This shows that under perfect competition, the total revenue of a firm increases due to increase in quantity given the price of the commodity in the market. Similarly, in the reverse way, if quantity falls from 4 to 3 *TR* decreases from 40 to 30 and so on.

Another point to be learnt about *TR* is that, it increases at a constant rate. Starting from 10, *TR* increases to 20, 30, 40 at a constant rate of 10 given the price and increase in each unit of quantity.

Coming to AR, since AR = $\frac{TR}{Q}$ or price, you may club them as a single column in the table instead of showing them separately. We have only given them in this table for the purpose of calculating AR and to show that it is same as price.

In the table, you can see that MR is also 10 at each point. In the beginning, MR is shown as 10 and TR = 10. It means that TR has increased form 0 to 10 when quantity has increased from 0 to 1. When quantity increases from 1 to 2, TR increase from 10 to 20. So $\Delta TR = 20 - 10 = 10 = 10$ and $\Delta Q = 2 - 1 = 1$. So MR at the 2nd quantity or 2nd unit of the commodity is given as $\frac{\Delta TR}{\Delta Q} = \frac{20-10}{2-1} = \frac{10}{1} = 10.$ Similarly when quantity increases from 2 to 3, *TR* increases from 20 to 30. So *MR* at 3rd unit of the good is given as $\frac{30-20}{3-2} = \frac{10}{1} = 10.$ and so on. *MR* shows the manner is which *TR* is increasing as a result of one unit increase in the quantity of the good. So *MR* in measured between two quantities.

Relationship between AR and MR and TR

From the table above we can easily state the relationship between *AR*, *MR* and *TR* of the firm under perfect competition as follows.

1. Since price or AR is given under perfect competition and is constant through out, AR and MR are always equal. i.e. AR = MR for competitive firm.
2. Between MR and TR, it can be said that MR is the rate of change of TR. In other words, the value of MR at any quantity gives the value at which TR has increased above its previous unit.

Diagrammatic Presentation

We can give the diagrams of *TR*, *AR* and *MR* as given in Fig. 23.1 below.

Take, *TR* first. In order to draw the diagram of *TR*, take the values of *TR* (as given the table) on the vertical axis and the different values of quantity (Q) on the horizontal axis. Plot each combination of *Q* and *TR* and join these combinations to get *TR* curve. Here *TR* is a straight line through the origin as shown in the diagram.

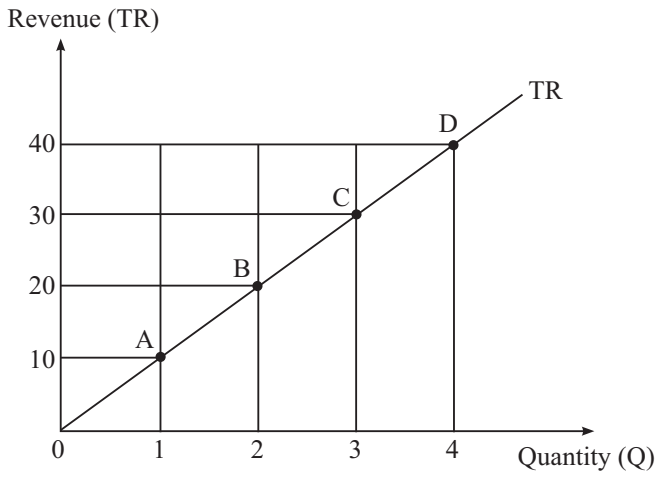


Fig. 23.1

As given in the diagram, the combination of Q = 1 and TR = 10 is plotted at point A. Point B shows Q = 2, TR = 20, point C shows Q = 3, TR = 30 and point D shows Q = 4 and TR = 40. Join 0, A, B, C and D to get TR.

The diagram for AR and MR for a firm under perfect competition is a horizontal line as shown in the diagram Fig. 23.2 below.

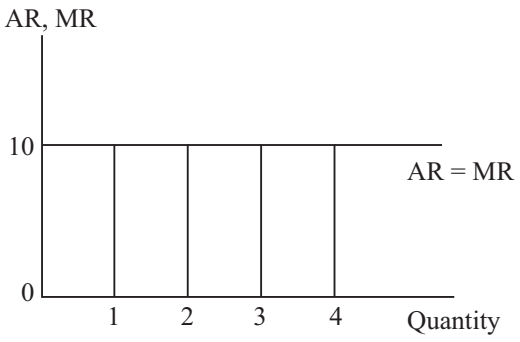
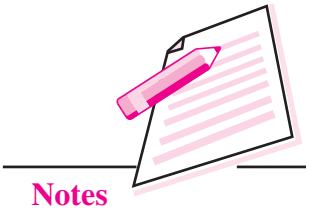


Fig. 23.2



In the table it is given that AR = MR = 10 at each quantity sold. So AR and MR start from 10 on the vertical axis which measures them. Then it becomes a horizontal line as there is no change in AR and MR with increase in quantity.

INTEXT QUESTIONS 23.1

1. Define TR, AR and MR symbolically.
2. If price is ` 5 and quantity sold increases from 6 to 7, find out TR, AR and MR?

   Where P = price, Q = Quantity,

   Δ = increase in.

23.2 VARIOUS CONCEPTS OF PROFIT

Profit is defined as the difference of total revenue (TR) over total cost (TC) of the firm.

So profit = TR – TC. Economists often distinguish between super normal profit and normal profit. Super normal profit is defined as the surplus of total, revenue over total cost. This means total revenue is greater that total cost. In order words if the difference between total revenue and total cost is positive or greater than zero, then we can say that the firm is earning super normal profit.

Example: A firm sells 5 units of a good at price 10. Its total cost of production is 40. Does supernormal profit exist, and how much?

Ans:

$$TR = 5 \times 10 = 50$$

$$TC = 40$$

$$TR - TC = 50 - 40 = 10$$

Since 10 > 0 i.e. TR – TC is positive, there is super normal profit which is equal to 10.

If we want to find out whether super normal profit exists at each unit of the output or at each quantity of the output then we must compare revenue and cost at each quantity.

You know that revenue per unit of the good is called average revenue (AR).

Similarly, cost per unit of the good is called average cost (*AC*). If *AR – AC* is positive or AR > AC then there will be super normal profit. You can use price instead of AR also.

Normal profit

When total revenue equals total cost, the difference between them becomes zero. Such a situation is called normal profit or zero profit. So normal profit means

$$TR - TC = 0 \text{ or } TR = TC.$$

This also means that *AR* or *P* equals *AC* if we divide quantity. i.e. $\frac{TR}{Q} = \frac{TC}{Q}$.

or $AR = AC$

Loss

When the firm's total cost exceeds total revenue , i.e. TC > TR the firm incurs loss. In other words loss of the firm implies that its TR is less than TC. At the unit level, loss means AR or P is less than AC (AR < AC). In a situation of loss the firm is not able to recover its cost of production after selling the product.

INTEXT QUESTIONS 23.2

1. The average cost of a firm is 10. It sold 10 units at a price of 10. What type of profit did the firm earn?
2. If TR > TC, then there is normal profit. True of false
3. If TR = TC, then there is super normal profit. True or false.
4. If AR < AC, then there is loss. True or false

23.3 PROFIT MAXIMIZATION OF A COMPETITIVE FIRM

The major objective of a firm is to maximize profit. To attain this we can explain two different approaches.

1. TR and TC approach
2. MR and MC approach

TR and TC approach

As we know that profit is the difference between total revenue and total cost, profit maximization through this approach states that the firm should produce that quantity of output at which the difference between total revenue and total cost is the maximum (*TR – TC* is maximum).

This can be explained by using the following table. [Recall the lesson on cost you have studied earlier).

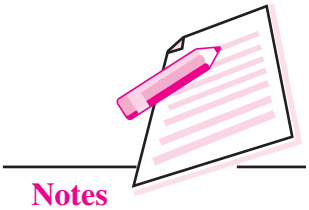


Table 23.2: Profit maximization of a firm: TR and TC approach

Q	TR	TC	TR–TC = Profit
1	10	15	–5
2	20	20	0
3	30	22	8
4	40	25	15 (TR – TC is maximum.)
5	50	40	10
6	60	60	0
7	70	85	–15

As shown in the table, the TR of a competitive firm is increasing at a constant rate of 10. It starts from 0 when quantity is 0, Then with in each unit increase in the quantity TR is increasing by 10 i.e. when Q = 1, TR = 10.

When Q = 2, TR = 20 and so on. On the otherhand TC of the firm is 15 even if Q = 0. This is because of presence of fixed cost as already told in the lesson on cost. TC slowly increases in the beginning and then increases fast with increase in quantity of output. At Q = 1, TC = 15, then at Q = 2, TC = 20 which is an increase of 5. When Q = 3, TC = 22 which is an increase of 2 i.e. less than the previous unit. After this TC increases faster which you can easily verify.

Now look at the column on profit, marked as TR – TC. At Q = 1, TR –TC = – 5. This means that there is loss at this level of output because TC > TR. So the firm must increase output. At Q = 2, TR = TC so that TR – TC = 0. Here the firm is able to recover the cost. At Q = 3, TR = TC = 8 and at Q = 4, TR –TC = 15. At Q = 5, TR – TC = 10 which has fallen from the previous level of 15. At Q = 6, TR – TC falls to 0 and then at Q = 7, TR – TC is again negative at – 15 indicating loss. From this it is clear that at Q = 4, TR – TC is maximum at 15. So firm must produce 4 units to maximize profit because here the difference between *TR* and *TC* is maximum.

Diagrammatic Presentation

We can show the profit maximization process in a suitable diagram given as fig. 23.3.

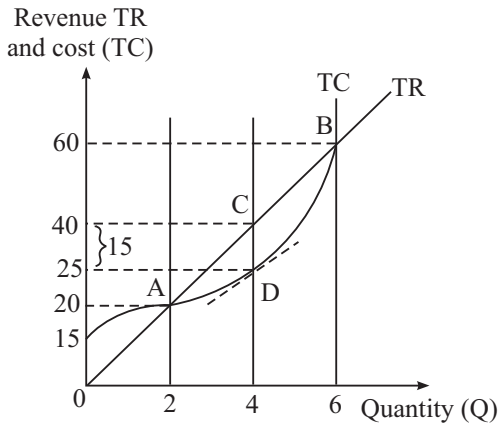


Fig. 23.3

In the diagram revenue and cost are measured on vertical axis. Quantity measured on horizontations. The TR is a straight line through the origin.

The *TC* curve starts from 15 on vertical axis and then rises like an inverse 'S' shaped curve as shown in the lesson on cost. From quantity 0 to 1 there is loss as $TC > TR$ here. At $Q = 2$, $TR = TC$. This is shown as *TR* and *TC* curves meeting at point A. At $Q = 4$, $TR = 40$, (which corresponds to) point *C* on TR curve. At the same level of Q = 4, point *C* and *TC* is 25, corresponding HO at point *D*. The distance *CD* is the maximum difference between *TR* and *TC*. Then at $Q = 6$, $TR = TC$ again and after that *TC* curve is above *TR* curve indicating loss. So at $Q = 4$, profit is maximized.

According to this Method, the profits of a firm can be estimated by calculating Margineal Revenue (It is the change in total Revenues by selling of additional Unit of Output) and Marginal cost (it is the addition to the total cost/Total variable cost by producing oe additional unit of Output) at difficult levels of Output the profit of a firm will be maximum at that level of output which MC is equal to MR.

$$MC = MR$$

or $$MR - MC = 0$$

MR and MC Equality approach to firms Equilibrium is bend on In (two) condtions.

(a) First order necessary condition. The Firm's MC must be equal to its MR at the equilibrium level of Output.

(b) Second order or sufficient conditioin. At the equilibrium level of Output the MC should be using i.e. the MC curve should have positive slope or MC curve intersects MR curve from below.

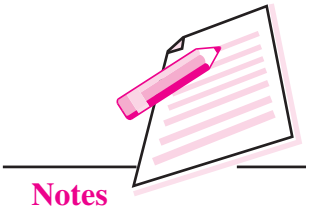


Table 23.3: Profit maximization through MC and MR Approach

Q	MR	MC	MR – MC	Total
1	5	8	–3	–0 loss
2	5	5	0	0
3	5	2	3	0
4	5	3	2	5 Profit
5	5	4	1	6
16	5	5	–0	
7	5	7	–2	0 loss

In the table quantity Q is increasing from 1 to 7. Marginal revenue (MR) is constant at 5 since the firm is under perfect competition (already told in the section on revenue). The marginal cost (MC) starts at 8 and then falls and increases to 5 and continues falling to 4 at Q = 5. After that MC rises to 5 at Q = 6 and then further rises to 7 at Q = 7.

From the behaviour of MR and MC, you can see that initially between Q = 0 to 1, MC > MR. As MC = 8 and MR = 5. At Q = 1, MC = MR = 5. Then between Q = 2 to Q = 6 MC lies below MR. Then again at Q = 6, MC rises to be equal to MR at 5. We can say that initially when MC > MR there is loss. So the firm must increase output. Then when MC = MR at Q = 2 there was no profit and no loss. But after that between Q = 3 to Q = 5, MC lies below MR. This is the zone of profit. For example at Q = 3, MR – MC = 5 – 2 = 3. At Q = 4, MR – MC = 5 – 3 = 2. At Q = 5, MR – MC = 5 – 4 = 1. At Q = 6, MR – MC = 5 – 5 = 0. i.e. We can say that profit starts at from 0 at Q = 2 to 3 at Q = 3, 2 at Q = 4, 1 at Q = 5 and 0 at Q = 6. Adding all these we get total profit to be 0 + 3 + 2 + 1+ 0 = 6, when Q = 6. After that at Q = 7, there is loss again. So profit is maximized at Q = 6. In the table it is clearly shown that MR = MC at two points, one when Q = 2 and then when Q = 6. However at Q = 2, profit was not maximum as the firm had loss earlier at Q = 1 with MC more than MR at the time. But at Q = 6, MC = MR, but total profit is already maximum as indicated by the fact that MC was less than MR when they become equal. Also after that MC exceeds MR creating loss. Hence at Q = 6, both the conditions of profit maximization are satisfied.

Diagrammatic presentation

The above table can be presented diagrammatically in fig. 23.4.

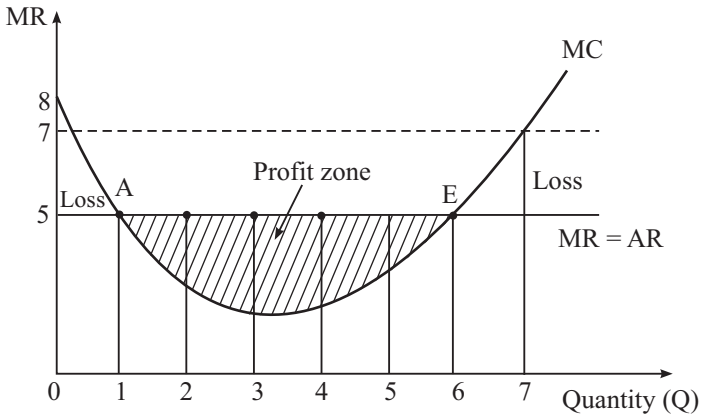


Fig. 23.4

In the diagram MR and MC are measured on vertical axis. Quantity is measured on horizontal axis. MR is horizontal at S. It is also same as AR as said earlier. MC is a 'u' shaped curve starting from see that initially when Q = 1, MC is above MR indication loss. Other MC Q = Z, MC = MR, at point A. Here MC units MR from above. MC lies below MR so profit stands from point A when Q = 2. Profits are napped as long as MC is less than MR and till they are equal at point when Q = 6. At point, E, MC = MR and MC is less than MR when they become equal. Diagrammatically it means that MC cuts MR from below. So "E" is the point of profit maximization which satisfies both the conditions.

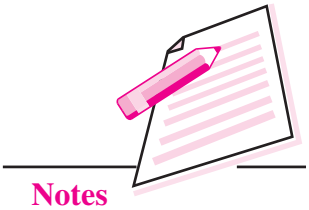
INTEXT QUESTIONS 23.3

1. Maximum profit implies that *MC* is above *MR* after both are equal.
   True or false.

2. At quantity 2, *TR* = *TC*. After that *TC* lies below *TR* and again they become equal at quantity. 6. Do you firm agree that profit maximizing output lies between these two quantities. Yes/No.

WHAT YOU HAVE LEARNT

- Total revenue (*TR*) is the total sales proceeds of the firm. *TR* = Price × Quantity.



- $AR = \frac{TR}{Q}$ and $MR = \frac{\Delta TR}{\Delta Q}$.
- *AR* and *MR* are equal under perfect competition.
- Super normal profit refers to a situation when *TR* > *TC* or *AR* > *AC*.
- Normal profit implies that *TR* = *TC* or *AR* – *AC*. It is also called zero profit.
- Loss implies that *TR* < *TC* or *AR* < *AC*.
- Profit maximizing output is that output where *TR* – *TC* is maximum as per *TR* and *TC* approach.
- As per *MR* and *MC* approach, profit maximizing condition are
  - (i) *MC* = *MR*
  - (ii) *MC* must be less than *MR* before they are equal.

TERMINAL EXERCISE

1. Define total revenue, average revenue and marginal revenue. Give their relationship.
2. Fill TR, AR and MR column.

P	Q	TR	AR	MR
20	4			
20	5			
20	6			

3. Distinguish between super normal and normal profit.
4. Write a short note on loss of a firm by giving numerical example?
5. Explain the profit maximization principle by using TR and TC approach. Give suitable diagram.
6. Explain profit maximization conditions of a competitive firm by using suitable diagram?
7. Construct an imaginary table show the profit maximization output by using TR and TC approach?
8. Construct an imaginary shown the profit maximizing output of a competitive firm by using *MR* and *MC* approach?

ANSWERS TO INTEXT QUESTIONS

23.1

1. $TR = P \times Q$, $AR = \frac{TR}{Q}$, $MR = \frac{\Delta TR}{\Delta Q}$

2.

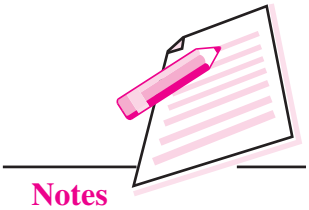
P	Q	TR	AR	MR
5	6	30	5	5
5	7	35	5	5

23.2

1. Normal profit or zero profit.
2. False
3. False
4. True.

23.3

1. True
2. Yes.



24

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NATIONAL INCOME AND RELATED AGGREGATES

The main objective of an economy is to provide goods and services for the satisfaction of different types of wants of the people. This objective is achieved through production process. During production process, income is generated in the economy.

Most of you must have heard or read about national income. It consists of two words national and income. Each of these words has specific meaning in economics. In this lesson, you will learn about the meaning of income, national income, and some basic concepts of national income. Without knowing these concepts it is very difficult to understand the meaning and the ways of measuring national income.

OBJECTIVES

After completing this lesson, you will be able to:

- make a distinction between factor incomes and non-factor incomes;
- understand the circular flow of income;
- know about basic economic activities;
- make distinction between closed the open economy;
- understand the concepts of stock and flow;
- understand the concept of domestic territory and normal residents of a country;
- distinguish between intermediate products and final products, value of output and value added, gross and net measures of value added;

- explain different types of factor incomes;
- understand the concepts of domestic product and national products;
- explain the concepts of nominal and real GDP; and
- understand the concepts of GDP, NDP, GNP and NNP at market price and factor cost.

24.1 MEANING OF INCOME

In the economy we receive different types of incomes. We receive wages and salaries from our employers. We receive interest on capital for lending money. We also receive gifts and donations from others without giving anything in return. All these incomes can be grouped into two types of incomes.

(A) Factor incomes

(B) Non-factor incomes

(A) Factor incomes

A factor income is the income accruing to a factor of production in return for the services rendered to the production unit. We know that production is result of the joint efforts of the four factors of production. These four factors of production are:

(i) Labour

Labour includes all physical and mental efforts of human beings used for production of goods and services. These physical and mental efforts are inseparable. A worker requires both. Some of the jobs requires more of physical labour than mental labour and some jobs require more mental labour than physical labour.

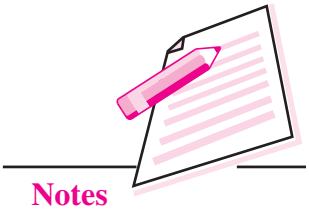
The remuneration paid to the workers is popularly termed as wages and salaries. In national income accounting, it is termed as compensation of employees.

(ii) Land

By land in economics we mean all that is given to us free by nature, on, below or above the surface of the earth. On the surface it includes, surface area of the soil, water, forests etc. below the surface it includes mineral deposits, water streams, petroleum etc., and above the surface it includes the sun, light, wind etc.

As the land became scarce, sale and purchase of land started.

Those who owned land started charging price for the use of land. Such a payment to the land owner/landlord is termed as rent.



(iii) Capital

Capital includes all the man made resources used for producing goods and services like structures on land, machines, equipments, vehicles, stock of materials etc.

The payment made to the owner of capital for the use of capital is termed as interest.

(iv) Entrepreneurship

It refers to the initiative taken by a person or a group of persons in starting and organising a business. Unless somebody takes this initiative, no business can be started. The one who takes this initiative is termed as entrepreneur.

The income accruing to the entrepreneur is termed as profit.

Thus compensation of employees, rent, interest and profit are factor incomes of the factor owners.

(B) Non- factor incomes:

There are certain money receipts which do not involve any sacrifice on the part of their recipients, the examples are gifts, donation charities, taxes, fines etc. No production activity is involved in getting these incomes. These income are called transfer incomes because such income merely represent transfer of money without any good or service being provided in return for the receipts. These incomes are not included in national income.

24.2 BASIC ECONOMIC ACTIVITIES

Production consumption and investment are three basis economic activities that take place in every economy

(a) Production

Production is addition of value to an existing commodity. During production process already existing commodities are made more useful by combined efforts of factors of production which increase their value. This increase in value is known as production. Suppose, a carpenter purchase wood worth ₹ 1000/- and makes furniture from it sells it for ₹ 2000/- In this production process he has added value of ₹ 1000/- (₹ 2000-1000)

(b) Consumption

Using up of produced goods and services for the direct satisfaction of individual

and collective wants of the people is called consumption. It includes all goods and services purchased by households like food items, clothes shoes etc. and by the government for collective consumption like, roads, bridges, parks, schools etc.

Investment/Capital Formation

Investment is that part of production which is left after consumption and used for creating physical assets like machines, equipments, material etc. It is that part of production which is used for further production. It increases the future production capacity of the economy.

The three activities of production, consumption and investment are interrelated and interdependent. Increase in production, increases both consumption and investment. Increase in consumption induces the producers to produce more in future. Increase in investment increases the future production capacity of a country which increases both production and investment. With out production there can be neither consumption nor investment. These three economic activities are responsible for generating the income flows in the economy.

24.3 CLOSED ECONOMY VS OPEN ECONOMY

In modern age, nearby every country has some economic relations with other countries. All the countries buy goods and services from other countries. Borrowing and lending also takes place among different countries. The people of one country also visit other countries. If the two countries have economic relations with each other, the real and money flows also take place between them.

An open economy is a term used for a country which has economic relations with the rest of the world. Most of the countries of the world are open economies. The closed economy is the term used for a country which has no economic relations with the rest of the world. Such economies are rare in the present day world.

24.4 STOCK AND FLOW

The distinction between stock and flows is very significant for national income estimates.

Stock: A stock is a quantity which is measured at point of time i.e. at 4 p.m. on 31st March etc. wealth, population, money supply etc. are stock concepts. It has no time dimension.

Flow: A flows is a quantity which is measured over a period of time i.e. days, month, years etc. It has time dimension. National income, population growth are flow concepts.

24.5 CIRCULAR FLOW OF INCOME

Production, consumption and investment are important economic activities of an economy. In carrying out these economic activities, people make transactions between different sectors of the economy. Because of these transactions, income and expenditure move in circular form. This is called circular flow of income. It is based on two principles.

(i) The expenditure of the buyer because the income of the sellers.

(ii) Good and services flow in one direction from sellers the buyers while money payment for these goods, and services flow in opposite direction i.e. from buyers to sellers.

In this way, the flow of goods and services (real flow) and flow of money payments (money flow) together make a circular flow.

Real flow

Households render factor services as owners of land, labour, capital and entrepreneurship to firms. The firms produce good, and services to meet the demand of the households. Such flow of factor services from households to firms and flow of goods and services from firms to households is know as real flow.

Money flow

In modern economies, goods and services and factor services are valued is terms of money. Households receive rent for land, wages for labour, interest for capital and profit for entrepreneurship- from firms and make payment for goods and services supplies by firms. This flow of money between firms and households is called money flow:

Circular flow can be shown with the help of a diagram given below:

Circular flow of income in a two sector economy without savings.

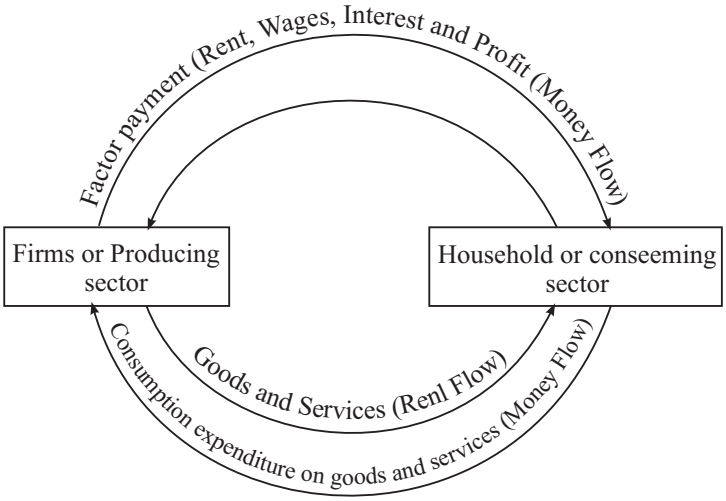

Factor payment (Rent, Wages, Interest and Profit (Money Flow)
Firms or Producing sector
Household or conseeming sector
Goods and Services (Renl Flow)
Consumption expenditure on goods and services (Money Flow)

Fig. 24.1

Different sectors of the economy and their inflows and outflows.

An open economy can by divided into following five sectors:

(i) Producing sector

(ii) Household sector

(iii) Government sector

(iv) Financial sector

(v) Rest of the world sector.

The circular flow of income among these sectors can be shown with the help of a chart given below:

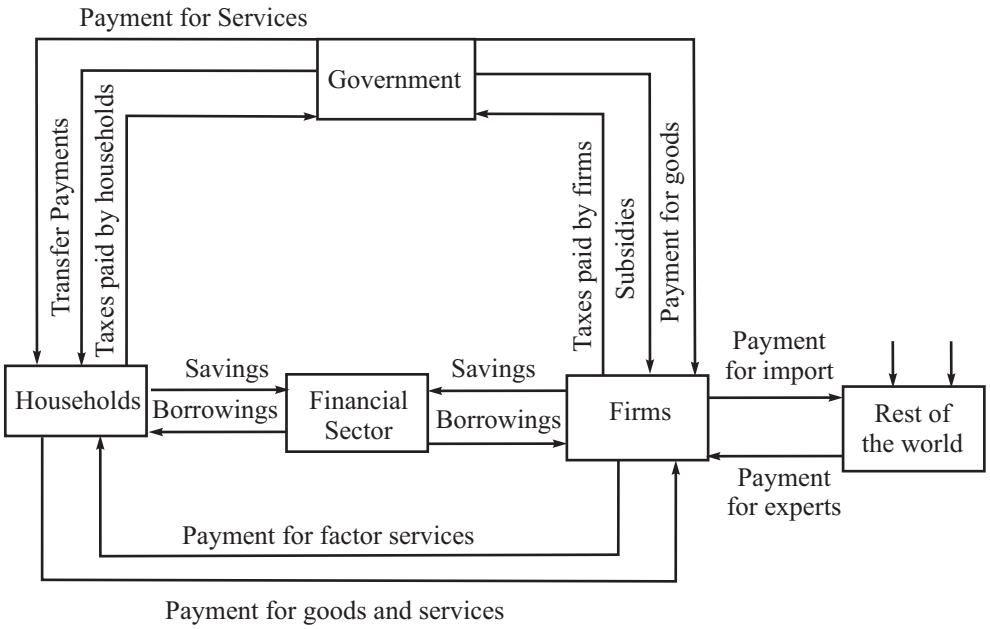


Fig. 24.2

1. Flows from and to the production units

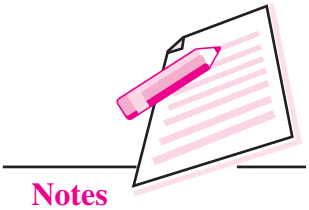
(a) They buy factor services from households (real inflow). In return they make payment in the form of wages, vent, interest and profits (money out flows)

(b) They deposit savings in financial sector (money outflow)

(c) They deposit savings in financial sector (real inflow) and in return make payments for import. (money outflow)

(d) They export goods and services (real outflow) and in return they get payments for the exports (money outflow)

(e) They pay taxes to the government (money outflow)



(f) They sell goods and services to households and government. (real outflow). In return, they get payment from households, (private consumption expenditure) and general government (government consumption expenditure) (money inflow)

(g) They receive subsidies from government. (money inflow)

(h) They borrow from the financial sector (money inflow)

2. Flows from and to the households:

(a) They buy goods and services from the production unit (real inflow) and in return make payments in the form of consumption expenditure (money outflow)

(b) They pay personal taxes to the government (money outflow)

(c) They deposit savings in the financial sector (money outflow)

(d) They sell factor services to the enterprises (real flow) and in return get factor incomes (money inflow)

(e) They get free services (real inflow) and transfer payment (money inflow) from government.

3. Flows from and to government

(a) It purchased goods and services from production units (real inflow) and in return makes payments i.e. government consumption expenditure (money outflow)

(b) It pays subsidies to the production units (money outflow)

(c) It provides free services to households (real outflow) and make transfer payments (money outflow)

(d) It deposits savings in the financial sector (money outflow)

(e) If receives taxes from production units (money inflow)

(f) It receives personal taxes from households (money inflow)

4. Flows from and to the financial sector

(a) It lends capital to the production units (money outflow)

(b) It receives savings from production units, households and government (money inflow)

5. Flows from and to the rest of the world

(a) Goods and services are imported from the rest of the world (real inflow) and in return payment are made (money outflow)

(b) Goods and service are exported to rest of the world (real outflow) and in return payment are received (money inflow)

Not all the flows influence the generation of national income. Some of these are non-factor or transfer incomes flows and have no effect on national income. The significance of the distinction between the two types of flows will become more clear when you will study lesson no. 25.

INTEXT QUESTIONS 24.1

(i) Name four factor of incomes.

(ii) What are transfer payments?

(iii) What is a closed economy?

(iv) Give any two examples each of stock and flow.

24.6 CONCEPTS RELATED TO NATIONAL INCOME

To understand the meaning of national income it is essential to understand some basic concepts related to national income and its related aggregates. These concepts are

24.7 DOMESTIC TERRITORY

The concept of domestic territory (Economic territory) is different from the geographical or political territory of a country. Domestic territory of a country includes the following

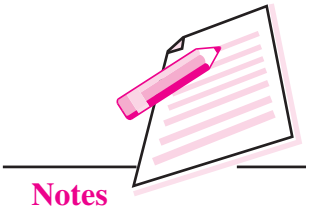
(i) Political frontiers of the country including its territorial waters.

(ii) Ships, and aircrafts operated by the normal residents of the country between two or more countries for example, Air India's services between different countries.

(iii) Fishing vessels, oil and natural gas rigs and floating platforms operated by the residents of the country in the international waters or engaged in extraction in areas where the country has exclusive rights of operation.

(iv) Embassies, consulates and military establishments of the country located in other countries, for example, Indian embassy in U.S.A., Japan etc. It excludes all embassies, consulates and military establishments of other countries and offices of international organisations located in India.

Thus, domestic territory may be defined as the political frontiers of the country including its territorial waters, ships, aircrafts, fishing vessels operated by the normal residents of the country, embassies and consulates located abroad etc.



24.8 NORMAL RESIDENT

The term normal resident is different from the term nationals (citizens). A normal resident is a person who ordinarily resides in a country and whose centre of economic interest also lies in that particular country. Normal residents include both nationals (such as Indians living in India) and foreigners (non-nationals living in India). For example, Nepalese living in India for more than one year and performing economic activities of production, consumption and investment in India, will be treated as normal residents of India.

On the contrary, Indian citizens, living abroad (say in USA) for more than one year and performing their basic economic activities there, will be treated as normal resident of that country where they normally reside. They will be considered as non-residents of India (NRIs).

24.9 INTERMEDIATE GOODS AND FINAL GOODS

To understand the concept of national income and its related aggregates it is necessary to understand the meaning and difference between intermediate goods and final goods.

(i) Intermediate Goods : Intermediate goods are those goods which are meant either for reprocessing or for resale. Goods used in the production process during an accounting year are known as intermediate goods. These are non-durable goods and services used by the producers such as raw materials, oil, electricity, coal, fuel etc. and services of hired engineers and technicians etc. Goods which are purchased for resale are also treated as intermediate goods. For example, Rice, wheat, sugar etc. purchased by a retailer/wholeseller.

(ii) Final Goods : Goods which are used either for final consumption by the consumers or for investment by the producers are known as final goods. These goods do not pass through production process and are not used for resale. For example, bread, butter, biscuits etc. used by the consumer.

Whether a good is a final good or an intermediate good depends on its use. For example; milk used by a sweet maker is an intermediate good but when it is used by the consumer it becomes a final good.

Intermediate goods are not included in the calculation of national income. Only final goods are included in the calculation of national income because value of intermediate goods is included in the value of final .goods. If it is included in national income it will lead to the problem of double counting.

24.10 VALUE OF OUTPUT AND VALUE ADDED

(i) Value of Output : Production units use non-factor inputs like raw materials (intermediate goods) and factor inputs (factors of production i.e. land, labour, capital and entrepreneurship) for production. Various firms and production units produce different types of-goods. Money value of all goods and services produced is known as value of output. (It means value of output includes value of intermediate goods also).

Thus;

Value of output = Quantity × Price

Producing units sell their output in the market. However, it is not necessary that the whole of the output produced during an accounting year is sold during that very year. Therefore, the unsold produce forms a part or the stock or inventories. So, change in stock or inventories is also a part of value of output. Thus, value of output can also be measured as

Value of output = Sales + change in stock

It is clear that value of output includes value of intermediate consumption also. National income does not include intermediate consumption expenditure. So for calculation of National Income it must be deducted from value of output to avoid the problem of double counting.

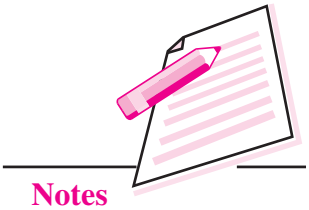
(ii) Value Added : After deducting value of intermediate goods from value of output we get value added. So, value added is the difference between value of output and intermediate consumption expenditure.

Value Added = Value of output - Intermediate Consumption Expenditure

The concept of value of output and Value Added can be explained with the help of an example. Suppose a farmer produces cotton worth ₹ 500 and sells it to the cloth mill. The cloth mill produces cloth worth ₹ 1,500. (Say produces 300 metres of cloth and market price of cloth is ₹ 5 per metre). But in this value, value of cotton is~ also included and cotton used by cloth mill is an intermediate good so value of cotton i.e. ₹ 500 will be intermediate cost. Therefore value added will be ₹ 1000/-

₹ 1500 – ₹ 500 = ₹ 1,000/-

Gross and Net Measure : The concept of 'Gross' and 'Net Measure' is very important for the calculation of national income. The value of output and value added calculated above is a gross measure because when goods are sold out in the market these include all type of costs. During production process fixed capital assets like machines, building etc. get depreciated and their value goes down. This



is known as normal wear and tear of machinery or consumption of fixed capital or depreciation. So every production unit makes provision for depreciation. When it is included in value, of output and value added, these are called Gross Value of output and Gross Value added respectively.

If depreciation is not included in value of output and value added these are called Net Value of output and net value added respectively.

Net Value of output = Gross Value of output – depreciation

Not Value of added = Gross Value of added – Depreciation

24.11 MARKET PRICE AND FACTOR COST

The buyers purchase goods from the market and the price paid by them is known as 'market price': The sellers pay a part of this price as 'indirect taxes' to the Government.

(i) **Indirect taxes** are those taxes which are levied by the government on sales and production and also on imports of the commodities in the form of sales tax, excise duties, custom duties etc. These taxes increase the market price of the commodities.

(ii) **Subsides :** Sometimes, Government gives financial help to the production units for selling their product at lower prices fixed by the government. Such help is given in case of those selected commodities whose production the Government wants to encourage. If we deduct these subsidies from indirect taxes, we get net indirect taxes.

(iii) **Net Indirect Taxes :** It is the difference between indirect tax and subsidy.

Net Indirect Tax = Indirect Tax - Subsidy

Value Added at Market Price - Net Indirect Tax (NIT)

= Value Added at Factor cost (FC)

Or Value Added at MP - Indirect Tax + Subsidy

= Value Added at FC

24.12 DOMESTIC INCOME VS NATIONAL INCOME

The sum total of value added by all production units within domestic territory of a country is called domestic product. Both residents and non-residents render factor services to these units. Therefore, the income generated in these units is shared by both the residents and non-residents as their factor income. To get contribution of only normal residents (or their factor income earned within the

domestic territory) we have to deduct the factor payments made to the non-residents. These factor payments are known as factor payments made to the rest of the world.

The residents, in addition to their factor services to the production units located in the economic territory of a country, also provide factor services to the production units outside the economic territory i.e., to the rest of the world (ROW). In return for these services they receive factor incomes from the rest of the world.

Thus, National income is the sum total of factor incomes earned by the normal residents of a country within and outside the economic territory. Therefore,

National Income = Domestic Income + Factor income received from ROW – Factor payments made to ROW.

Net Factor Income from ROW : It is the difference between factor income 's received from ROW and factor payments made to ROW.

National Income/Product = Domestic Income/product + Net factor income form abroad

Accordingly,

(i) Gross Domestic Product at market price + Net factor income from abroad = Gross National Product at market price.

(ii) Net Domestic Product at market price + Net factor income from abroad = Net National Product at market price.

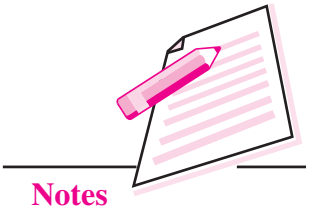
(iii) Net Domestic Product at Factor cost + Net factor income from abroad = Net National Product at factor cost.

It is Net National Product at factor cost which is called **National Income** of a country.

Nominal and Real GDP

When the money value of goods and services included in GDP is estimated on the prices of current year, it is called GDP at current prices or nominal GDP. Here current prices mean the prices of the year of which GDP is estimated. For example, for estimating GDP for the year 2012-13 if we use the prices prevailing in the year 2012-13, we shall get nominal GDP.

On the other hand, when the value of goods and services included in GDP is estimated on the prices of base year, we get GDP at constant prices or real GDP. Increase in real GDP implies increase in the production of goods and services. Therefore, the calculation of GDP at constant prices or real GDP gives us the correct picture of the economic performance of an economy.



INTEXT QUESTIONS 24.2

Choose the correct alternative

(i) The term 'domestic' territory in national income is associated with:

A. Economic territory

B. Geographical territory

C. Residents

D. Citizens

(ii) By deducting intermediate consumption expenditure and net indirect taxes from the value of output we get

A. Gross value added at market price.

B. Gross value added at factor cost.

C. Net value added at market price.

D. Net value added at factor cost.

(iii) By deducting consumption of fixed capital and intermediate cost from the value of output we get:

A. Gross value added at market price.

B. Gross value added at factor cost.

C. Net value added at market price.

D. Net value added at factor cost.

(iv) Value added is a measure of the contribution of

A. a resident.

B. a production unit.

C. an entrepreneur.

D. a worker.

(v) The expenditure on goods and services purchased for resale by a production unit is

A. Intermediate cost.

B. Value of final products.

C. Value of output.

D. Factor cost.

(vi) National income of a country is same as

A. Gross National Product at market price.

B. Net National product at factor cost.

C. Gross National Product at factor cost.

D. Net National Product at market price.

(vii) The difference between domestic income and national income is of

A. Net indirect taxes

B. Net factor income from abroad

C. Depreciation

D. Intermediate consumption expenditure

24.9 NATIONAL INCOME AS AGGREGATE OF FACTOR INCOMES

A production unit is formed by the four factors of production, land, labour, capital and entrepreneurship. During production process they generate income. This generated income is known as Net Value Added at FC (NVA at FC). Net value added at factor cost is distributed among the owners of four factors of production in the form of following factor incomes.

(a) Compensation of employees

Compensation of employees includes all monetary and non-monetary benefits that accrue to the employees on account of labour services rendered by them in the production process. The employees get wages or salaries. In addition they may get many other benefits as employees like bonus, employer's contribution to provident fund, free accommodation, free conveyance, free medical facilities, free holiday trips, etc.

(b) Rent

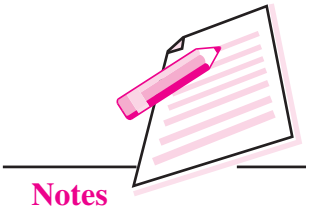
It is a factor income earned from lending the services of buildings and subsoil assets for production of goods and services.

(c) Interest

Interest is the income earned by those who provide funds to the production units. Any interest payment against loans given to consumers to meet consumption expenditure is not a factor payment and so can not be treated as factor income.

(d) Profit

Profit is the income accruing to the entrepreneur for his entrepreneurial services (i.e. bearing risks and uncertainties in the business) to the production units. It is a



residual income left after making factor payments out of the value added in the form of compensation of employees, rent and interest.

(e) Mixed Income of self employed

Mixed income of self employed is the income generated by self employed persons like doctors, lawyers, farmers, shop keepers etc. A self employed person provide his labour as well as his property in his work and generally does not keep accounts in a manner so that the factor payments are clearly identified. For example, a small shopkeeper starts his business in his own house employing his own labour and capital. Hence, the income of this small shopkeeper will be termed as mixed income of self employed.

National Income as aggregate of factor incomes

National Income = Compensation of employes + Rent + Interest + profit + Mixed income + Net factor income from ROW.

or National Income = NDP at FC + Net Factor income from ROW.

24.10 NATIONAL INCOME AS AGGREGATE OF FINAL EXPENDITURE

Income generated during production process in the form of factor incomes is spent by the factor owners on final consumption and investment goods. All consumer goods are generally final goods. Durable producer's goods like machines and buildings which are used again and again in the production process are also final goods because they are not further sold.

Demand for final goods are made by all the three sections of the economy, namely households, firms and the government. The purchases for final consumption are made by the households and the government. The purchases for investment are made by the production units within the economic territory. Accordingly, the final expenditure is classified into

(a) Private final consumption expenditure

(b) Government final consumption expenditure

(c) Investment Expenditure

(d) Net exports.

(a) Private Final Consumption Expenditure

Private Final Consumption Expenditure includes purchases by the households and the non-profit institutions serving housholds. The households purchase goods and

services for satisfaction of wants of their family members. The non-profit institutions serving households consist of institutions like mosque, temples, churches, gurudwaras, charitable hospitals, etc. who provide goods and services to the households free of cost.

Final consumption Expenditure includes expenditure made by the households and non profit institutions on the purchase of the following items

(i) Consumer non-durable goods like fruits, vegetables etc. These goods are used up in a single act of consumption.

(ii) Consumer durable goods like washing machines, furniture etc. These goods are used for a longer period of time.

(iii) Consumer services like education facilities, transport facilities, doctor's services etc. All these services are consumed as soon as they are produced.

(b) Government Final Consumption Expenditure (GFCE)

Government Final Consumption Expenditure is the expenditure on the free services provided to the people by the government. The main examples of these services are that of police, military, educational institutions, hospitals, roads, bridges, legislatures and other government departments.

(c) Investment Expenditure

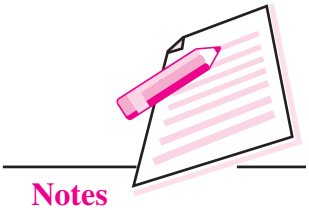
Expenditure incurred by production units on the purchase of physical assets such as machines, building etc. during an accounting year, is known as investment expenditure.

There are five categories of investment (Gross domestics capital formation). These are

(i) **Gross Business fixed investments :** Business fixed investment is the amount spent by the business units on the purchase of new capital assets like plants, machinery, equipments etc. These are durable producers goods that is why we call these expenditures as a fixed investment. If we deduct depreciation from it will be net business fixed investment.

(ii) **Inventory investment or stock investment :** Inventory investment includes net increase in the stock of raw materials, semi finished goods and finished goods with producers,. It is essential for continuous supply of goods and services by the producers.

(iii) **Residential construction investment :** The amount spent on the building of housing units is regarded as residential construction investment in national income accounting.



(iv) Public Investment : It includes all investment by the Government such as expenditure on building roads, hospitals, schools etc.

(v) Net exports: Exports refer to expenditure by foreigners on goods and services produced in our domestic territory whereas, imports refer to our expenditure on foreign Good and services. Net exports are a difference of exports and imports.

INTEXT QUESTIONS 24.3

Choose the correct alternative:

(i) Which of the following is not treated as compensation of employees?

A. Payment of salary.

B. Payment of bonus.

C. Payment of travelling expenses on a business tour.

D. Free accommodation..

(ii) Rent in national income estimates accrues to

A. Land used for production.

B. Structure erected on land used for production.

C. Land and structure both used for production.

D. Land and structure used for residence.

(iii) The GVA at MP exceeds NVA at MP by the amount of

A. Indirect taxes

B. Subsidies

C. Consumption of fixed capital

D. Net factor income from abroad.

(iv) National product exceeds domestic product by the amount of:

A. Exports

B. Factor income received less factor income paid to abroad

C. Factor income received from abroad.

D. Imports

(v) The final expenditure is the expenditure on :

A. Consumption only.

B. Investment only.

C. Both consumption and investment.

D. Neither on consumption nor on investment.

(vi) Domestic product at market price exceeds domestic product at factor cost by:

A. Net factor income from abroad.

B. Consumption of fixed capital.

C. Net indirect taxes.

D. Exports.

24.11 NATIONAL INCOME AND ITS RELATED AGGREGATES

After understanding the related concepts of national income you can easily understand the, meaning of national income and its related aggregates. The related aggregates of national income are

(i) Gross Domestic Product at Market price (GDP_{MP})

(ii) Gross Domestic Product at Factor Cost (GDP_{FC})

(iii) Net Domestic Product at Market Price (NDP_{MP})

(iv) Net Domestic Product at FC or (NDP_{FC})

(v) Net National Product at FC or National Income (NNP_{FC})

(vi) Gross National Product at FC (GNP_{FC})

(vii) Net National. Product at MP (NNP_{MP})

(viii) Gross National Product at MP (GNP_{MP})

(i) Gross Domestic Product at Market Price : It is the money value of all the final goods and services produced within the domestic territory of a country during an accounting year.

GDP_{MP} = Net domestic product at FC (NDP_{FC}) + Depreciation + Net Indirect tax.

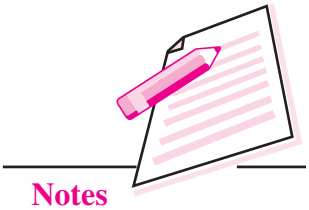
(ii) Gross Domestic Product at FC : It is the value of all final goods and services produced within domestic territory of a country which does not include net indirect tax.

$GDP_{FC} = GDP_{MP}$ – Indirect tax + Subsidy

or $GDP_{FC} = GDP_{MP}$ – NIT

(iii) Net Domestic Product at Market Price : It is the money value of all final goods and services produced within domestic territory of a country during an accounting year and does not include depreciation.

$NDP_{MP} = GDP_{MP}$ – Depreciation



(iv) Net Domestic Product at FC : It is the value of all final goods and services which does not include depreciation charges and net indirect tax. Thus it is equal to the sum of all factor incomes (compensation of employees, rent, interest, profit and mixed income of self employed) generated in the domestic territory of the country.

NDP_{FC} = GDP at MP – Depreciation – Indirect tax + Subsidy

(v) Net National Product at FC (National Income) : It is the sum total of factor incomes (compensation of employees + rent + interest + profit) earned by normal residents of a country in an accounting year

or

NNP_{FC} = NDP_{FC} + Factor income earned by normal residents from ROW - factor payments made to ROW.

(vi) Gross National Product at FC = It is the sum total of factor incomes earned by normal residents of a country along with depreciation, during an accounting year.

GNP_{FC} = NNP_{FC} + Depreciation

(vii) Net National Product at MP : It is the sum total of factor incomes earned by the normal residents of a country during an accounting year including net indirect taxes.

NNP MP = NNP_{FC} + Indirect tax – Subsidy

(viii) Gross National Product at MP : It is the sum total of factor incomes earned by normal residents of a country during an accounting year including depreciation and net indirect taxes.

GNP_{MP} = NNP_{FC} + Dep + NIT

INTEXT QUESTIONS 24.4

Fill in the blanks with the help of the clues given below

Net Indirect Taxes, Subsides, Depreciation, Factor incomes earned by normal residents from ROW

(i) GDP_{MP} = NVA_{FC} + Depreciation + ...

(ii) NDP_{MP} = GDP_{MP} – .....

(iii) NNP_{FC} = NDP_{FC} + ... - Factor Payments made to ROW.

(iv) GDP_{FC} = GDP_{MP} - Indirect Taxes + ...

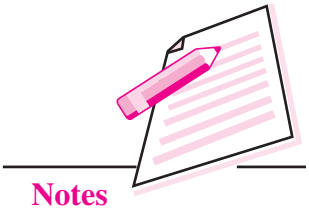
(v) NDP_{FC} = GDP_{MP} - Depreciation - .....

WHAT HAVE YOU LEARNT

- The term 'domestic' in domestic income is associated with 'economic territory'.
- The intermediate goods are those goods which are purchased by production units from other production units and are meant either for resale or for further production. Final goods are those goods which are acquired for final consumption and investment.
- During production process production units generate income known as net value added at factor cost.
- The excess of value of output over intermediate consumption is 'value added'
- Gross concept includes depreciation while net concept does not include it.
- GVA at MP = Value of output - Intermediate Cost.
- Net indirect taxes = Indirect Tax - Subsidy.
- NVA at MP = GVA at MP - Consumption of fixed Capital.
- NVA at FC = NVA at MP - indirect taxes + subsidies.
- The economic territory of a country is different from its geographical territory.
- Sum total of value added by all production units located in economic territory of a country is domestic product.
- Domestic product + net factor income received from abroad is national product.
- Net national product at factor cost is same as national income.
- The concept of resident is different from the concept of citizen.
- The factor incomes are : compensation of employees accruing to labour, rent to land owners, interest to capital owner and profits to entrepreneur. Mixed income is a mixture of factor incomes and it is difficult to allocate it among different factor incomes.

TERMINAL EXERCISE

1. Explain the concept of economic territory.
2. Explain the concept of residents.
3. Differentiate between intermediate products and final products? What is the significance of this distinction?
4. Explain the concept of value added by giving a numerical example.
5. The following information is given:
   (a) Value of output
   (b) Indirect taxes



(c) Intermediate cost

(d) Consumption of fixed capital.

(e) Subsidies.

Derive the following measures of value added on the basis of the above information.

(i) GVA at MP

(ii) GVA at FC

(iii) NVA at MP

(iv) NVA at FC

6. Name different factor incomes and explain briefly their meaning.
7. What is 'mixed income'? Why is there a need for such concept?
8. Name different type of final expenditures. Explain briefly their meaning.
9. Name the related aggregates of national income.
10. Explain the circular flows of income in a two sector economy.
11. Explain the relationship among the three basic economic activities.
12. Distinguish between intermediate goods and final goods
13. What are transfer payments? How do they differ from factor payment?

ANSWERS TO INTEXT QUESTIONS

24.1

(i) Compensation of employees, rent, interest and profit

(ii) Read section 24.1 B

(iii) Read section 24.3

(iv) Read section 24.4

24.2

(i) A (ii) B (iii) C (iv) B (v) A (vi) B (vii) B

24:3

(i) C (ii) C (iii) C (iv) B (v) C (vi) C

24.4

(i) Net Indirect taxes; (ii) Depreciation; (iii) Factor income earned from ROW; (iv) Subsides (v) Net Indirect Taxes.

Notes

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25

NATIONAL INCOME AND ITS MEASUREMENT

In the previous lesson you have learnt about the various concepts relating to national income and their related aggregates Understanding of these concepts is necessary for measuring national income.

In this lesson, you will learn how national income is measured. In lesson No. 24 you have learnt that national income is a flow. This flow can be looked at from three different angles.. Hence, there are three different methods of measuring national income. Each one of these methods is explained in details in this lesson.

OBJECTIVES

After completing this lesson, you will be able to:

- define national income;
- relate the national income from three different angles;
- identify production units located in the economic territory of a country into different industrial sectors;
- explain the meaning of the primary, secondary and tertiary sectors;
- explain the production method (or value added method) of measuring national income;
- explain the precautions to be taken while measuring national income by production method;
- explain the income distribution method of measuring national income;
- explain the precautions to be taken while measuring national income by income distribution method;

- explain the final expenditure method of measuring national income;
- explain the precautions to be taken while measuring national income by final expenditure method;
- show that all the three methods of measuring national income lead to the same result; and
- calculate private income, personal income, personal disposable income, national disposable income (gross and net).

25.1 METHODS OF MEASURING NATIONAL INCOME

The production units produce goods and services. For this they employ four factors of productions viz, land, labour, Capital and entrepreneurship. These four factors of production jointly produce goods and services i.e. they add value to the existing goods. This value added i.e. net domestic product is distributed among the owners of four factors of production receive rent, compensation of employees, interest and profit for their contribution to the production of goods and services. The incomes received by the owners of the factors of production are spent on the purchase of goods and services from the production units for the purpose of consumption and investment. In short, production generates income. Income is used for expenditure, and expenditure, in turn, leads to further production. There are three phases of circular flow of national income. So there are three methods of measuring national Income. They are

(A) Output or value added method

(B) Income method

(C) Expenditure Method.

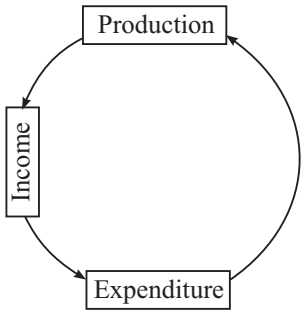


Fig. 25.1: Three phases in the circular flow of national income.

25.2 VALUE ADDED METHOD

With the help of this method national income is estimated at production level. At production level national income is the value of final goods and services produced in a country within the domestic territory plus net factor income from rest of the world. In this method following steps are involved:

Firstly, all the producing enterprises in an economy are broadly classified into three industrial sectors according to their activities. These are:

Primary sector: Primary sector consists of those producing units which are carried out by using natural resources. It includes productive activities like agriculture, forestry, fishing mining etc.

Secondary sector: This sector includes those producing units which transform inputs into output for example: transformation of wood into a chair. It includes sub sectors like construction, manufacturing, electricity, gas and water supply.

Tertiary sector: Producing units of this sector produce services of all kinds such as banking, trade, transport etc. This is also known as service sector. This sector includes transportation, communication, banking services etc.

Secondly: Net value added of each producing unit of the economy is estimated from their gross value of out put which is calculated by multiplying total volume of goods produced with their prices. After deducting the sum of value of intermediate goods (IG), depreciation and net indirect taxes (NIT) from value of output we get net value added at FC of the producing units. or

Net value added at FC = Gross value of output - IC - Dep - NIT

By adding up net value added at FC of all the producing units of a sector we get net value added at FC of that particular sector. The sum total of net value added at FC of all the three sectors in the domestic territory of a country gives us Net Domestic Product at Factor Cost.

Thirdly: Net National Product at factor cost is obtained by adding net factor income from ROW to net domestic product at factor cost.

If net factor income from ROW is negative, NDP at FC will be greater than net national product at factor cost (National Income), and if it is positive national income will be greater than NDP at FC.

From value of output to National Income (Production Method Value Added)

Intermediate Consumption				
Consumption of fixed capital	Consumption fixed capital			
Net Indirect taxes (NIT)	NIT	NIT		Net Factor Income from ROW
NVA_{FC} in the Tertiary Sector	NVA_{FC} in the Tertiary Sector	NVA_{FC}, in the Tertiary Sector	NVA_{FC} in the Tertiary Sector	NDP_{FC}=
NVA_{FC} in the Secondary Sector	NVA_{FC} in the Secondary Sector	NVA_{FC} in the Secondary Sector	NVA_{FC} in the Secondary Sector	compensation of employees + Rent + Interest + Profit
NVA_{FC} in the Primary Sector	NVA_{FC} in the Primary Sector	NVA_{FC} in the Primary Sector	NVA_{FC} in the Primary Sector	+ Mixed Inceome
Gross Value of output at MP	GDP at MP	NDP at MP	NDP at FC	NNP at FC (National Income)

Chart 25.2

Numerical Example

1. Calculate Gross value added at factor cost from the following :

(i)	Gross value of output at MP	10,500
(ii)	Depreciation	1000
(iii)	Indirect taxes	750
(iv)	Economic subsidies	200
(v)	Intermediate consumption	4000
(vi)	Compensation of employees	2000

Solution

Gross value added at Factor cost will be calculated as under:

Gross value of output at MP	10,500
+ Economic Subsidies	+200
– Intermediate Consumption	–4000
– Indirect Taxes	–750
	₹ 5950

Precautions

The following precautions are necessary while estimating national income by production method

(i) **Production for self consumption :** That output which is produced for self-consumption and whose value can be estimated, must be included in the estimates of production because it is a part of production of current year.

(ii) **Sale of second hand goods :** The sale of second hand goods should not be included in national income because the value of these goods had already been included earlier.

(iii) Commission paid to the broker for sale and purchase second hand goods should be included because it is payment made for the services provided in the current year.

(iv) Value of intermediate goods should not be included because it leads to double counting.

(v) Services of house wife should not be included because it is very difficult to evaluate them.

INTEXT QUESTIONS 25.1

Fill in the blanks with the help of clues given below Primary sector, secondary sector, Industrial sectors, value of production for self consumption tertiary sector.

(i) Fishing is a part of ..... sector

(ii) The first step of estimating national income with the help of value added method is to identify the different economic activities and classifying them into different ..... according to their activities.

(iii) ..... should be included in the estimation of value of output.

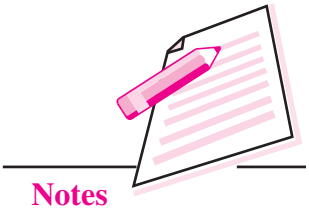
(iv) Transportation is a part of ..... sector.

25.3 INCOME METHOD

Income method is used for measuring national income at distribution level. According to this method, national income is estimated by adding incomes earned by all the factors of production for their factor services during a year. If includes the following steps:

(i) **Firstly:** Classify the production units into primary, secondary and tertiary sector. The classification is same as in value added method

(ii) **Secondly:** Estimate the following factor incomes paid out by the production units in each industrial sector.



(i) Compensation of employees

(ii) Rent

(iii) Interest

(iv) Profit

(v) Mixed income of self employed

The sum total of the above factor incomes paid out is the same as net value added at factor cost by the industrial sectors.

Thirdly : Take the sum of factor payments by all the industrial sectors to arrive at the net domestic product at factor cost. .

Lastly : Add net factor income from abroad to the net domestic product at factor cost to arrive at net national, product at factor cost.

National Income and Related Aggregates (Income Method)

					Net Indirect taxes
Net Indirect Taxes				Consumption of fixed capital	Consumption of fixed capital
Consumption of fixed capital	Consumption of fixed capital		Net factor in come from ROW	Net factor in come from ROW	Net factor in come from ROW
Profit	Profit	Profit	Profit	Profit	Profit
Interest	Interest	Interest	Interest	Interest	Interest
Rent	Rent	Rent	Rent	Rent	Rent
Mixed income of self employed	mixed income	mixed income	mixed income	mixed income	mixed income
Compensation of employees	Compensation of employees	Compensation of employees	Compensation of employees	Compensation of employees	Compensation of employees
GDP at MP	GDP at FC	NDP at FC	NNP at FC (National Income)	GNP at FC	GNP at MP

Chart 25.3

Numerical Example

1. Calculate national income from the following data:

		(₹ Crores)
(i)	Consumption of fixed capital	50
(ii)	Employers contribution to social security	75
(iii)	Interest	160
(iv)	Net Indirect Taxes	55
(v)	Rent	130
(vi)	Dividends	45
(vii)	Corporate Tax	15
(viii)	Undistributed profit	10
(ix)	Net factor income from abroad	–10
(x)	Wages and salaries	450

Solution

$$\text{NDPfc} = (X) + (ii) + (iii) + (v) + (vi) + (vii) + (viii)$$

$$= 450 + 75^* + 160 + 130 + 45 + 15 + 10 = 885 \text{ Cr.}$$

$$\text{NNP at fc} = \text{NDPfc} + (ix)$$

$$= 885 + (-10) = 875 \text{ Cr.}$$

Notes of solution

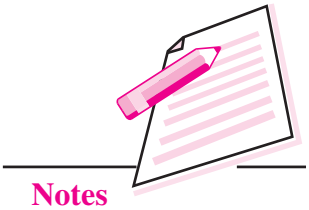
- Since wages and salaries and employer contribution to social security are given separately, these must be added to obtain compensation to employees.
- Dividend, undistributed profit and corporate taxes are to be added to get Total profit/Retained Earnings.
- Net indirect taxes, is not required in this question. Similarly consumption of fixed capital is also not required in this question.

Precautions

The following are some of the main precautions which must be taken while estimating national income by the income distribution method

(a) While estimating compensation of employees all benefits accruing to the employees whether in cash or in kind must be included.

(b) In estimating interest, the interest on only those loans should be included which are taken for production, The interest on loans taken to meet consumption expenditure is not included in national income as it is treated as transfer payment.



(c) Gifts, donations, charities, taxes, fines, income from lotteries etc., are not factor incomes but transfer incomes. These should not be included in estimating national income.

(d) Income from sale of second hand goods should not be included as it is not the income received from the goods produced in the current year.

INTEXT QUESTIONS 25.2

Which of the following are included in National Income and why as per Income Method.

(a) The Income of dertist.

(b) Rent Recieved on two Bed room Apartment.

(c) The Service of painter painting his own room

(d) The monthly pocket money received by student from his father.

25.4 FINAL EXPENDITURE METHOD

National income can also be measured at disposition phase with the help of expenditure method. It estimates national income by measuring final expenditure on gross domestic product at market price.

Expenditure incurred on final goods is final expenditure. Final goods are those goods which are demanded for final consumption and investment. The demand for final consumption and investment is made by all the four sectors of the economy, namely, households, firms and the government and rest of the world.

The main steps involved in measuring national income by this method are:

Firstly: Estimate the following expenditure incurred on the final products of all the sectors of the economy.

(i) Private final consumption expenditure.

(ii) Government final consumption expenditure.

(iii) Gross Investment

(iv) Net exports (exports - imports).

The sum total of all the above expenditures on final products of all the sectors of the economy gives us gross domestic product at market price.

Secondly: Deduct consumption of fixed capital (Depreciation) and net indirect taxes from gross domestic product at market price to get net domestic product at factor cost.

NDPFC = GDPmp - consumption of fixed capital - Net indirect tax (indirect taxes - subsidies)

Thirdly: Add net factor income from abroad to the net domestic product at factor cost to obtain net national product at factor cost which is the national income.

NNPFC = NDPfc + net factor income from abroad

(National Income)

National Income (Expenditure Method)

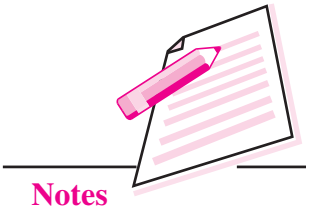
Gross Investment	(-) Depreciation		
Private Final consumption expenditure		(-) Net Indirect Tax	+ Net Factor Income from Abroad
Govt. Final consumption expenditure			
Net Exports (Exports - Imports)			
GDP_{MP}	NDP_{MP}	NDP_{FC}	NNP_FC (National Income)

Chart 25.4

Numerical Example

Calculate national income from the data given below by expenditure method.

	Item	₹ (In crores)
(i)	Personal consumption expenditure	3500
(ii)	Consumption of fixed capital	50
(iii)	Net fixed capital formation	1250
(iv)	Change in stock 500 (v) Exports	400
(vi)	Imports 750 (vii) Net indirect taxes	40
(viii)	Governments' consumption expenditure	1600
(ix)	Net factor income from abroad	(-) 10
(x)	Wages and salaries	450



Solution

	₹ (In crores)
Personal Consumption expenditure	3500
+ Net fixed Capital Formation	1250
+ Change in Stock	500
+ Govt. Consumption Expenditure	1600
+ Net Exports (Exports-Imports)	-350
Net Domestic product at market price	**6500**
(-) Net Indirect Taxes	40
Net Domestic product at Factor Cost	**640**
+ Net factor Income from abroad	(-) 10
NNP FC (National Income)	**6450**

Please Note

1. Since Net Fixed Capital Formation is given, we are asked to calculate net National Product at factor cost. Thus, consumption of fixed capital is not required here.
2. Since, fixed capital is given, we need to add change in stock to get the total domestic capital formation (Investment)
3. The entry wages and salaries are not required here.

Precautions

The main precautions required to be taken in estimating national income by expenditure method are:

(i) Expenditure on intermediate products should not he included to avoid the problem of double counting.

(ii) Expenditure on gifts, donations, taxes, scholarships etc. should not be included in National Income as these are transfer payments.

(iii) Expenditure incurred on purchase of second hand goods should not be included as the expenditure on these goods has already been included when bought for the first time.

(iv) Expenditure on purchase of bonds and shares should not be included as these are financial transactions.

INTEXT QUESTIONS 25.3

Which of the following are included in GDPmp and why as per Expenditure Method.

(a) A purchase of a share.

(b) Construction of a room in existing building.

(c) Purchase of machinery.

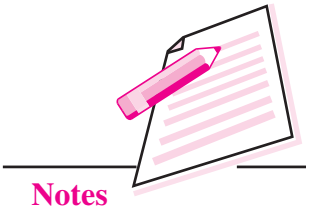
(d) Money received by student who has sold his book back to book seller.

25.5 RECONCILIATION OF THE THREE METHODS

The three methods are summarized in the following table:

Value Added Method	Income Distribution Method	Final Expenditure Method
Sum of GVAmp, of all industrial sectors	Compensation of employees	Private final consumption expenditure.
	+ Rent	+ Government final consumption expenditure
	+ Interest	+ Gross domestic capital formation (Gross Investment)
	+ Profit	+ Net exports
	+ Mixed Income	
	+ Consumption of fixed capital	
	+ Indirect Tax	
	– Subsidy	
= GDP_{MP}	GDP_{MP}	= GDP_{MP}
– consumption of fixed capital	– Consumption of fixed capital	– consumption of fixed capital
– indirect taxes	– Indirect tax	– indirect taxes
+ subsidies	+ Subsides	+ subsidies
+ Net factor income from abroad	+ Net factor income from abroad	+ Net factor income from abroad
= NNPfc	= NNPfc	= NNPfc

Chart 25.5



INTEXT QUESTIONS 25.4

Fill in the blanks:

Tertiary, compensation, transfer, investment, consumption

(i) Gifts, donations taxes etc. are ..... payments.

(ii) Interest payment on loans taken to meet ..... expenditure is not treated as factor income.

(iii) Benefits in kind received by the employees is a part of the ..... of employees.

(iv) The expenditure on purchasing furniture by a production unit is a part of .....

(v) Employing of domestic servant is a part of ..... sector.

25.6 NATIONAL PRODUCT AND OTHER AGGREGATES

We have already studied that the sum of net value added by all the production units in the domestic territory is net domestic product of factor cost (NDP_{fc}). All the income generated in a year is not received by consumer households. Income from property and entrepreneurship accruing to the departmental commercial enterprise of the government is retained by the government. Secondly non-departmental enterprises of the government save a part of their profits for future expansion. This sum also is not available for distribution. It these two sums are deducted from NDP_{fe}, we get income from domestic product or NDP_{fc} accruing to private sector.

Income from domestic product accruing to private sector = NDPfe – income from property and entrepreneurship accruing to government administration department savings of non-departmental enterprises.

(i) Private income: Private income consists of factor incomes earned within the domestic territory and abroad by private enterprises and workers (factor owners in the private sector) and current transfer from government and the rest of the world.

Private income = Income from domestic product accruing to private sector + Net factor income from abroad + national debt interest + current transfers from government + other current transfers from the rest of the world (net)

(ii) Personal income : Personal income is defined as the current income of persons or households from all sources. We have to deduct undistributed profit and corporate tax payable by the enterprise from private income to arrive at personal income

Personal inome = private income - saving of private corporate sector (undistributed profit) - corporation tax

(iii) Personal disposable income: The household cannot spend the entire personal inome. Government takes away a part of it by way of inome tax and other miscellaneous taxes such as education tax, fire tax, sanitation tax. These taxes have to be deducted from personal income to arrive at personal disposable income.

Personal disposable income = Personal inome – direct taxes paid by the households – miscellaneous receipts of the government.

Personal disposable inome is the inome available to persons from all sources to dispose of as they choose.

27.7 NATIONAL DISPOSABLE INOME (NET AND GROSS)

National disposable income refers to the inome which is available to the whole country for disposal. It includes both earned inome and transfer income (unearned income)

Net national disposable inome = NNP_{mp} + Net current transfers from rest of the world.

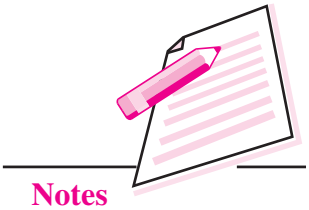
or NNP_{fc} + NIT + Net current transfer from rest of the world

Gross National Disposable income = GNP_{mp} + Net current transfers from rest of the world.

Numerical examples on calculator of national income and other related aggregates

Example 1: From the data given below, calculate private income:

		(₹ in crores)
(i)	NDPfc	2,000
(ii)	Income from property and entrepreneurship accruing to government]	100
(iii)	Saving of non-departmental enterprises	20
(iv)	National debt interest	5
(v)	Net factor income from abroad	(-)10
(vi)	Net current transfers from government	15
(vii)	Net current transfers from ROW	25



Soution:

Income from domestic product accruing to private sector

= NDPfc – (ii) – (iii)

= 2000 – 100 – 20

= ₹ 1880 Crores

Private income = Income from domestic product accruing to private sector

+ (iv) + (v) + (vi) + (vii)

= 1880 + 5 + (-)10 + 15 + 25

= ₹ 1915 crores

Example 2: Calculate (a) personal income (b) Personal disposable income

		₹ in crore
(i)	Private income	1915
(ii)	Income from domestic product accruing to private sector	1880
(iii)	Net factor income from abroad	(-) 10
(iv)	Corporation tax	25
(v)	Savings of private corporate sector	15
(vi)	Direct taxes paid by households	25
(vii)	Other miscellaneous receipts of government administrave departments	5

Soution:

(a) Personal income = Private income – (iv) – (v)

= 1915 – 25 – 15

= ₹ 1875 crores

(b) Personal disposable income

= personal income – (vi) – (vii)

= 1875 – 25 – 5

= ₹ 1845 crores

Example 3: Calculate (a) Gross National disposable inocme (b) Net National disposable income

		₹ in crore
(i)	NNP_{fc}	3,000
(ii)	Net current transfers from government	20
(iii)	Net current transfers from Row	25
(iv)	Net indriect taxes	50
(v)	Depreciation	40

Soution:

(a) Gross National Disposable income

= GNPmp + Net current transfers from Row

= [(i) + (v) + (iv)] + (iii)

= 3000 + 40 + 50 + 25

= ₹ 3115 crores

(b) Net national disposable income

= NNP_{mp} + Net current transfers from ROW

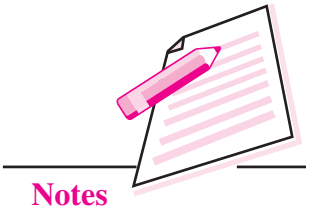
= [(i) + (iv)] + (iii)

= 3000 + 50 + 25

= ₹ 3075 crores

WHAT YOU HAVE LEARNT

- There are three phases of circular flow of national income. Accordingly there are three methods of measurement of national income: value added or production method, income distribution method and final expenditure method.
- The first step in the measurement of national income of a country is to classify its production units into different industrial sectors. The primary sector includes all units engaged in exploiting natural resources. The secondary sector transforms one good into another good. The production units in the services sector produce services.



- The main steps in the value added method are: estimate NVAfc by all sectors and add them to arrive at NDP_{FC}. Add net factor income from abroad to NDP_{FC} to obtain NNP_{FC}.
- The main steps in the income distribution method are: estimate factor incomes paid out by each sector; take the sum of these incomes paid out by all the sectors to get, NDP_{FC}; add net factor income from abroad to get NNP_{FC}.
- The main steps in the final expenditure method are: estimate the sum of final expenditure on consumption and investment to get GDP_{MF}, deduct consumption of fixed capital and indirect taxes and add subsidies to GDPmp to arrive at NDP_{FC} and add net factor income from abroad to NDPfc to get NNPFC.

TERMINAL EXERCISE

1. Explain the three phases of circular flow of national income.
2. Explain the nature of functions of primary, secondary and tertiary sectors.
3. Explain the steps taken in measuring national income through the value added method.
4. What are the main precautions required to be taken in estimating national income by the value added method?
5. Explain the steps involved in estimating national income through the income distribution method.
6. What are the main precautions required to be taken in estimating national income by the income distribution method?
7. What are the main steps in the expenditure method of estimating national income?
8. Point out some of the precautions taken in estimating national income through the final expenditure method.
9. From the following data, estimate the net value added at factor cost and show that it is equal to the sum of factor incomes :

(i)	Sales	9600
(ii)	Increase in stock	2080
(iii)	Intermediate Consumption	2370
(iv)	Depreciation	450
(v)	Wages and salaries	5400
(vi)	Internet	250
(vii)	Rent	750
(viii)	Profit	2150
(ix)	Net indirect Taxes	310

10. Find out "Net value added at factor cost by an enterprise from the following data:

		₹ In crores
(i)	Consumption of Fixed Capital	10
(ii)	Subsidies	5
(iii)	Indirect Taxes	25
(iv)	Purchase of material and Services from other production units	75
(v)	Value of output	125

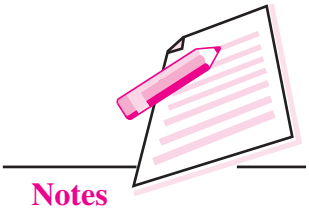
(Ans. = 70 Corers)

11. Calculate value added by Firm A & B from the following data:

		₹ (Lakh)
(i)	Purchase by Firms B from Firm A	40
(ii)	Sales by Firm B	80
(iii)	imports by Firm. B	10
(iv)	Rent Paid by Finn B	05
(v)	Opening stock of Firm B	15
(vi)	Closing stock of Firm B	20
(vii)	Purchases by Firm A from Firm B	20
(viii)	Closing stock of Firm A	20
(ix)	Opening stock of Firm A	10

12. From the data given below, calculate
    (a) National income
    (b) Private income
    (c) Personal income
    (d) Personal disposable income
    (e) Gross National disposable income

		₹ (in crores)
(i)	Compensation of employees	1000
(ii)	Mixedx income of self employed	2500
(iii)	Depreciation	50
(iv)	Net factor income from abroad	20
(v)	Rent	200
(vi)	Interest	100



(vii)	Profit	500
(viii)	Net Indirect taxes	300
(ix)	National debt interest	70
(x)	Current transfers from governmment	60
(xi)	Net current transfers from ROW	70
(xii)	Corporation tax	30
(xiii)	Savings of private corporate sector	20
(xiv)	Direct taxes paid by households	15

ANSWERS TO INTEXT QUESTIONS

25.1

(i) Primary sector (ii) Industrial sectors (iii) Production for self consumption (iv) tertiary

25.2

(a) Included, as it is payment for final service/factor payment.

(b) Included, as it is payment for final service used by the tenant.

(c) Excluded, as it is not a market transaction.

(d) Excluded, as it is a transfer payment (unilateral payment or unearned income).

25.3

(a) Excluded, as it is mere transfer of ownership from one person to another.

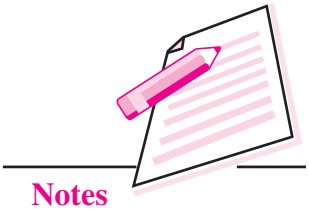
(b) Included, as it is a part of gross Investment.

(c) Included, as it is a part of gross Invesmtment.

(d) Excluded, as it is second hand transaction and value had already been counted at the time of its production.

25.4

(i) Transfer (ii) consumption (iii) compensation (iv) investment (v) tertiary



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CONSUMPTION, SAVING AND INVESTMENT

Production, consumption and capital formation are three basic economic activities of an economy. This lesson deal with the study of consumption and capital formation in the economy as a whole. It should be noted that 'capital formation' can be referred to as saving or investment depending on the context in which the term is being used. You have already gone through the study of consumption at a micro level in the lessons on utility analysis, indifference curve approach and demand analysis. *The theory of consumption at micro level courses on consumption behaviour of the economy as a whole at an aggregate level. Also saving and investment at aggregate level will be dealt with.*

OBJECTIVES

After completing this lesson, you will be able to:

- define consumption function and saving function;
- explain propensity to consume and save;
- identify the factors determining propencities to consume and save; and
- distinguish between autonomous and induced investment.

26.1 CONSUMPTION FUNCTION

Everybody needs income to purchase goods and services. Higher the level of income, higher will be the capacity to buy the goods and services. So for an individual, the total amount of goods and services to be purchased depends on the available disposable Income of the Consumes. Similarly, taking all the individuals living in the society or economy as whole into consideration, it can be said that the

aggregate consumption of all depends on the total income generated in the economy. When the total income of the economy increases total consumption of the economy will also increases. In the same way, it can also be said that economy with higher level of national income consumes more than the economy which has lower level of national income.

Example 1: In India the household finall consumption expenditure as percentage of GDP increased from 59 per cent in 2011 to 60 percent in 2012 with increase in GDP. In USA, which is a developed economy the share of household consumption expenditure in its GDP is 69 percent in 2012 which was higher than that of India.

The relationship between consumption and the level of income in called consumption function. Consumption function tells that consumption is a function of income, or in other words, consumption depends on the level of income.

If should be noted here that, when we talk about income, we normally mean disposable income. Disposable income is that part of total income which is available for consumption and saving. To elaborate it further, note that when a person receives income in return of factor services rendered by him/her, he/she may not spend all the income on consumption only. There are certain compulsory payments he/she has to make out of the income received, such as tax to the government, fines if any etc. As a result the income available for consumption needs is reduced. Disposable income is defined as the income remained after payment of tax and fines etc. If tax payment in high, disposable income will be lower and vice versa. Accordingly, the level of consumption will be affected.

It should be noted that disposable income and total income will be same if tax payment and fine are not existing or zero.

Example 2: Individual A receives an income of Rs 10,000. He paid income tax at a rate of 2 percent. What is his disposable income?

Ans: 2 % of 10,000 = tax paid = 200

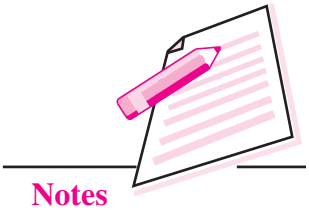
Hence disposable income = 10000–200 = Rs. 9,800.

Example 3: Individual B receives an income of Rs 5000. He has not paid any tax. What in his disposable income?

Ans: Since tax paid = 0, disposable income is same as total income, i.e.

5000 – 0 = Rs 5000.

In this lesson we will treat income and disposable income as one and the same.



26.2 PROPENSITY TO CONSUME

The relationship between consumption and (disposable) income can be further elaborated by studying propensity to consume. Under this we compare the figures of consumption and income in each time period. In order to establish the nature of relationship between them, two important calculations are made in this context. One, Average propensity to consume (APC) and two, Marginal propensity to consume (MPS).

APC (Average Propensity to Consume)

APC is defined as the ratio of consumption to income. This ratio in calculated to know the proportion of income devoted for consumption purposes in the specific period of time for which data is given. So APC is calculated for each time period. Let consumption for any particular time is denoted as 'C'. Let income of that period is denoted as Y. Then

$$\text{APC} = \frac{\text{C}}{\text{Y}}$$

Example 4: If consumption is Rs 300 Cr. and income is Rs 600 crore, what is APC? What does this imply?

Ans: $\text{APC} = \frac{300}{600} = \frac{1}{2} = 0.5$

This implies that on an average 50 percent of the total income has been spent on consumption.

Example 5: In the country *X*, 70 percent of the income has been devoted to consumption. If income is Rs1000 crore, find out consumption?

Ans: $\text{Consumption} = \frac{70}{100} \times 1000 = 700$

Consumption = Rs 700 crore.

Hint: Here APC = 70 percent, Y = 1000

since $\text{APC} = \frac{\text{C}}{\text{Y}}$, $C = APC \times \text{Y}$

Example 6: In a country, consumption amount is Rs. 800 crore which is 80 percent of its total disposable income? What is the amount of disposable income?

Ans: Disposable Income = Rs 1000 crore.

[Hint: Here APC = 80 percent, C = 800

Since APC $= \frac{C}{Y}$, $Y = \frac{C}{APC}$. So Y = $Y = \frac{800}{\frac{80}{100}} = 800 \times \frac{100}{80} = 1000$

MPC (Marginal propensity to Consume)

MPC is the ratio of change in consumption to change in income between two time periods. Denote "increase in" as "Δ", We can write

$$MPC = \frac{\Delta C}{\Delta Y}.$$

Since consumption depends on income, increase in income will bring about increase inconsumption over time period. In this context, MPC measures the increase in the amount of consumption due to increase in the amount of income in the country.

Example 7: If consumption in period 1 is 200 and income is 300 and the same for period 2 stands at 250 and 400 respectively, find MPC?

Ans: $MPC = \frac{\Delta C}{\Delta Y} = \frac{250-200}{400-300} = \frac{50}{100} = 0.5$

From the above example, you can make out that Δ is the difference between the values of two periods i.e.

Δ = Value of current period – value of last period.

The famous economist, Keynes, who gave the concept of propensity to consume, said that, MPC is normally less than unity. Symbolically,

MPC < 1.

Since $MPC = \frac{\Delta C}{\Delta Y}$, this implies that $\frac{\Delta C}{\Delta Y} < 1$.

This further implies that ΔC < ΔY.

Putting it in words, it can be said that increase in consumption is less than the corresponding increase in income. Note that in example 6 above, MPC = 0.5 which is less that 1.

Psychological law of consumption: Let us ask why MPC is less than 1?

To answer this question, Keynes has provided the "Psychological law of consumption."

According to this law, as income increases over time, consumption on also increases, but at a slower rate as compared to that of income.

So the reason behind MPC being a fraction (less than one) is given in terms of psychological behaviour of the individuals taken together in the economy. It is commonly observed that people do not consume the entire part of increase in their income. They, certainly increase the amount of consumption with increase income as they get a scope to increase their level of satisfaction. But, at the same time, they do wish to save a part of the increase in income for future needs. Saving a part of income for future reflects a sense of security which is psychological in nature.

So increase in income is divided between increase in consumption and increase in saving. Symbolically, we can write that

$$\Delta Y = \Delta C + \Delta S.$$

i.e. increase in income = increase in consumption + increase in saving. From this it is clear that ΔC is less than ΔY. So MPC or in less than one.

INTEXT QUESTION 26.1

1. Consumption depends on (a) saving, (b) disposable income, (c) needs (d) none of the above
2. A person pays 20 percent of his income as tax. If income is 2000, find out disposable income?
3. Total income is same as disposable income if
   (a) consumption = 0, (b) Saving = 0
   (c) tax and fines = 0, (d) income = 0.
4. Given that consumption is 500 and income in 700. Find out APC?
5. Give to increase in income from 1000 to 1500, consumption has increased from 750 to 900. Find out MPC?

26.3 EQUATION OF CONSUMPTION FUNCTION

Economist Keynes, provided the equation of consumption function. He assumed a short run period in which the economy is functioning. He argued that short run is more important because people are more concerned about their immediate consumption needs. He argued that even consumption depends on the level of income, people still manage to consume the necessities needs to sustain oneself, even if there is no income for the time being. To explain this further, think that an

individual is waiting to receive his income after two months. Does it mean that he will start consuming only after two months! No. He has to take food and wear clouses which are bare necessities of life. He has to purchase these either by borrowing money or by arranging the money by selling some of his assets. He will repay the loan or recover the asset after he gets his income after two months but as of now, he is having some consumption even if his income is zero for the time being.

Similarly in the economy, there are children and old people who do not have any income but they consume by depending on others who are earning. For example in a family, children depend on their working parents to consume goods and services. An old person depends on the income of his son or daughter or pension from the government to consume things he needs now.

Hence, at any point of time in the short run there is some fixed amount which the population of the economy spent on consumption even if income is zero or nothing. This part of consumption is called autonomous or fixed consumption. It is a constant and can take any numerical value. Let us denote this value as a.

The other part of consumption comes from the income and the manner in which it increases over time. Once people start getting their income, they use it to repay the loans taken earlier, save for future and spend a fraction on consumption, over and above the fixed amount of consumption which they had already made earlier. The additional consumption over and above the fixed consumption on necessary things in influenced by the level of income received and MPC of the people. MPC comes into picture here because it reflects the consumption behaviour of the population out of their income.

On the basis of the above arguments as provided by Keynes, we can write the equation of consumption function in the following manner:

Consumption = Some fixed amount plus MPC times the current level of income.

Symbolically,

$$C = a + MPC \times Y$$

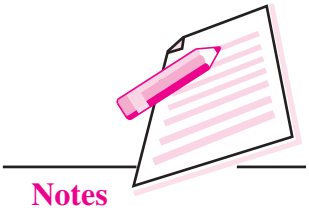
where C = Consumption

or Y = fixed consumption

(Fixed consumption is also called Autonomons consumption i.e. COnsumption at Zero level of Income)

Y = Income (disposable Income)

$$MPC = \frac{\Delta C}{\Delta Y}$$



MPC is less than one.

Denote MPC as '*b*'.

Then equation for consumption in given as

$$C = a + bY.$$

Example 8: In an economy, the population spend Rs 500 crore on absolute necessities needed to sustain themselves. The current income is Rs 2500 crore and MPC is 0.5. What is the level of consumption?

Ans: $C = 500 + 0.5 \times 2500$

$= 500 + 1250 = 1750$

So consumption is Rs. 1750 crore.

Now, find, the value of consumption (C) If income is zero i.e.

$Y = 0,$

Since $C = a + b\,Y$

Putting $Y = 0$, it becomes

$C = a + b.\ 0$

or $C = a.$

So when income in nothing, consumption is equal to the fixed amount which people require to sustain themselves.

In the above example, putting Y = 0,

We get C = Rs 500 crore.

What will happen if Y in changed to Rs 3000 cr. Then $C = 500 + 0.5 \times 3000$ so C = 500 + 1500 i.e. C = Rs 2000 cr.

This implies that given the value of 'a' and MPC (*b*), *C* will be determined as per the value of Y.

Diagram of consumption Function: The above equation of consumption function can be shown diagrammatically. Note that in the above equation there are two variables–consumption (*C*) and income (Y). Consumption (*C*) is determined depending on the value of Y, given the value of '*a*' and MPC. While drawing the diagram of consumption function on a graph paper, take C values along the vertical axis and the income or Y values along the horizontal axis. The diagram is shown below.

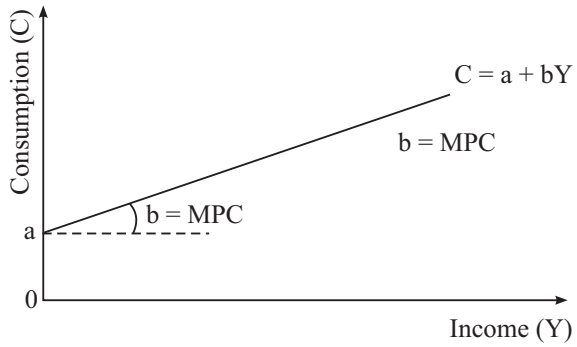


Fig. 26.1

As shown in the fig. 26.1 above, consumption function (C) starts from a point at 'a' on the vertical axis. This means that, if we put income Y, equal to zero, then *C* equals *a* as said above. The distant '0' a is the measure of fixed consumption amount in the economy when income is zero. When Y increases along horizontal axis, then *C* will also increase at a rate equal to MPC (b) along the line aC. aC is the consumption function.

Take the example given above where we have said that $C = 500 + 0.5 \times 2500$.

It can be shown in the following fig. 26.2.

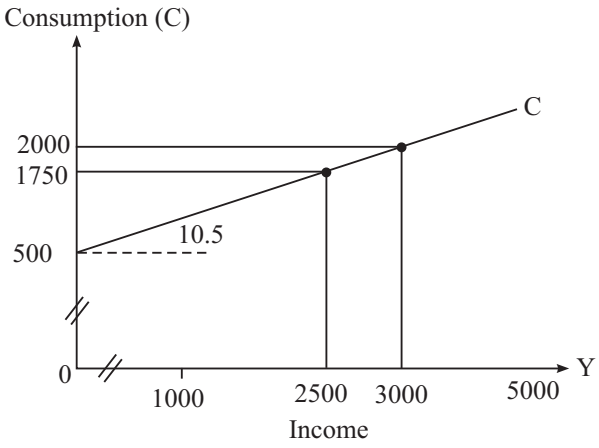
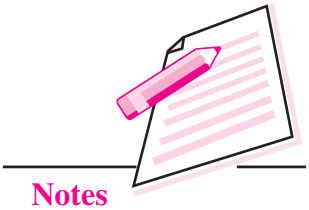


Fig. 26.2

Since a = Rs 500 crore in the example, the consumption function will start from 500 on the vertical axis. The function will rise at an angle 0.5 as MPC = 0.5. See that when Y = 0, *C* = a = 500. At Y = 2500, *C* = 1750 and at Y = 3000 *C* = 1500 as calculated earlier. Note that with increase in income, consumption rises at a rate equal to MPC. So the slope of consumption function in MPC.

Diagrammatically, consumption function can be described as a straight line



originating from a point on the vertical axis and slopping upwards from left to right rising at an angle equal to MPC.

Break even point

We saw that when income $Y = 0$, C = a (positive value). When income increases above zero then C will also increase at the rate of MPC. Initially C may be more than Y due to the presence of the fixed value 'a'. But when Y starts in-creasing, C will also increase at a lower rate than that of Y as per psychological law of consumption. So, a time will come when C will fall below Y after getting equal to it. The point where income and consumption are equal, is called the "break even " point in the economy.

Take the earlier equation again.

$C = 500 + 0.5 \times Y$.

Where $a = 500$, MPC = 0.5. Now, put different values of Y, starting from zero and determine the values of C accordingly. You can easily find the point where $C = Y$ as given in the table below.

Table 26.1: Break even point

Y	C	Remark	
0	500	$C > Y$	
500	750	$C > Y$	
1000	1000	$C = Y$	break even
1500	1250	$C < Y$	
2000	1500	$C < Y$	

As show in the table using the equation we find that when Y = 0, C = 500. Then when Y takes the value **500, C becomes low, C also becomes 1000**. This is the break even point. After that when Y further increases beyond 1000, C increases but remains below Y as shown in the table. At Y = 1500, C = 1250 and so on.

INTEXT QUESTION 26.2

1. Write the equation for consumption function, C given that fixed consumption amount is 100, MPC = 0.75 and income is denoted as Y.
2. If fixed consumption is 50, MPC = 0.8 and income is 200, what will be the value of consumption?
3. What is the slope of consumption function called?

4. Consumption function is a downward sloping line. True or False.
5. The distance between the origin and the point from which the consumption function starts on the vertical axis is a measure of–
   (a) saving (b) income
   (c) fixed consumption (d) disposable income.

Determinants of propensity to consume

It is commonly asked that what are the factors that influence consumption behaviour in the economy besides income? In other words what are the determinants of propensity to consume other than income? Let us identify some important factors as follows:

(i) Rate of interest, (ii) Wealth (iii) Distribution of income (iv) consumer credit.

(i) Rate of interest

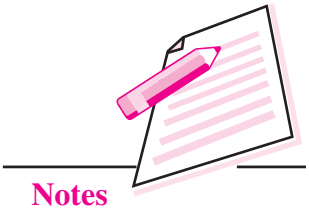
Commercial bank offer a certain rate of interest on the deposits held by public and charges rate of interest on the loans given to public. When people donot want to purchase goods and services, they keep their money in the bank to earn rate of interest. But when they want to buy goods and services, they with draw money from the bank and loose interest in the process. In this way rate of interest play an important role in influencing a person's decision to consume now or in futrue.

It should also be noted here that, according to Keynes, rate of interest may not be an important factor in influencing consumption decision in a short run time period. Urgent and immediate consumption needs have to be satisfied without considering the rate of interest factor. This happens because consumption is directly related to satisfaction of wants at present which is more important than earning rate of interest in future by deferring consumption today.

For investors and producers, however, rate of interest play an important role in their decision making regarding capital investment. To make investment producers need loan from bank. If the rate of interest in high the cost of borrowing will be high. This may discourage them to invest as per their desire and or need. On the otherhand, if the rate of interest is low, producers may be encouraged to invest more.

(ii) Wealth

Propensity to consume is influenced by a person's holding of wealth. People who have wealth in the form of gold, jewellery, ownership of land and building, shares and bonds etc enjoy a higher level of income generated from the wealth, Accordingly their consumption level will be higher.



(iii) Distribution of Income

Propensity to consume is affected by the distribution of income in the economy. You know that national income is distributed in the form of wage, rent, interest and profit. It is often observed and experienced that wage earners are exploited by the people who own property and business and earn rent, interest and profit. As a result there exist ineqality in income distribution leading to division of the society into poor and rich. It is obvious that rich people consume more than poor people. Accordingly the economy's propensity to consume will be affected.

(iv) Consumer credit

Finally, availability of consumer credit influences consumption behaviour to a large extent in the economy. There are many durable goods which consumers want to buy. But due to lack of credit facility, they are not able to buy them as they are costly items. Items such as car, scooter, TV, refrigerator, washing machine etc. are costly durable goods and also necessary for satisfaction of wants. Working people in urban area have got high demand for these goods.

With easy credit facility provided by banks, now people are buying these items in large quantities by paying easy instatments to the banks.

Saving Function

Both consumption and saving form two parts of a person's disposable income. The way consumption depends on the level of disposable income, saving also depends on the same.

Saving function gives the relationship between saving and income in the economy. Saving can be defined as that part of income (or disposable income) which is not consumed. This follows from the psychological law of consumption stated earlier. Let us denote saving as *S*.

In order to calculate saving, use example 7 given earlier in this lesson. In that example we had written that

$C = 500 + 0.5$ Y. Taking Y as 2500 we calculated that (C = 1750).

From this example we can calculate saving by deducting consumption from income. That is

$$S = Y - C$$

or

$$S = 2500 - 1750 = 750.$$

26.4 PROPENSITY TO SAVE

Saving behaviour of people can be studied by calculating propensity to save in two ways.

(i) Average propensity to save (APS)

(ii) Marginal propensity to save (MPS).

APS: APS is defined as the ratio of saving and income at any point of time. Symbolically

$$APS = \frac{S}{Y}$$

APS gives the idea about the proportion of income devoted towards saving MPS.

MPS

MPS is defined as the ratio of change in saving and change in income. Over a period of time. MPS is a rate of change in saving vis-a-vis income. Symbolically

$$MPS = \frac{\Delta S}{\Delta Y}$$

where ΔS = current period saving - last period saving

ΔY = current income – last period income

MPS in always less than 1.

Example: If income changes from 1000 to 1500 and saving changes from 200 to 250, then calculate APS and MPS?

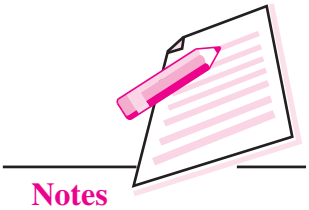
Ans: $MPS = \frac{\Delta S}{\Delta Y} = \frac{250-200}{1500-1000} = \frac{50}{500}$

$$= \frac{5}{50} = \frac{1}{10} = 0.1$$

We can calculate APS for both time period. In the first time period, S = 200 and Y = 1000

So, $APS = \frac{S}{Y} = \frac{200}{1000} = 0.2$

In the second time period



$$APS = \frac{S}{Y} = \frac{250}{1500} = \frac{1}{6} = 0.16$$

Relationship between propensity to consume and save

APC and APS are related in the following manner.

(i) The sum of APC and APC is unity.

i.e. $APC + APS = 1$

This implies that

$$APC = 1 - APS$$

$$APS = 1 - APC$$

Proof : $$APC = \frac{C}{Y}$$

$$APS = \frac{S}{Y}$$

$$APC + APS$$

$$= \frac{C}{Y} + \frac{S}{Y}$$

$$= \frac{C+S}{Y} = \frac{Y}{Y} = 1$$ (Since $C + S = Y$) Proved.

(ii) The sum of *MPC* and *MPS* in unity.

i.e. $MPC + MPS = 1$

This means that

$$MPC = 1 - MPS$$

$$MPS = 1 - MPC$$

Proof: $$MPC = \frac{\Delta C}{\Delta Y}$$

$$MPS = \frac{\Delta S}{\Delta Y}$$

MPC + MPS

$$= \frac{\Delta C}{\Delta Y} + \frac{\Delta S}{\Delta Y}$$

$$= \frac{\Delta C + \Delta S}{\Delta Y} \qquad (\because \Delta C + \Delta S = \Delta Y)$$

$$= \frac{\Delta Y}{\Delta Y} = 1 \text{ proved.}$$

Deriving the Equation for Saving

We have already given the consumption function equation as:

$$C = a + b\,Y.$$

We also said that Saving is calculated by deducting consumption from income.

i.e. $S = Y - C$

Now substitute value of C as given in the equation.

So, $S = Y - \{ a + b\,Y \}$

$= Y - a - b\,Y$

$= - a + Y - b\,Y$

Factor out Y to give

$$S = - a + (1 - b)\,Y.$$

The saving equation consists of the negative value of the fixed consumption '*a*' and (1–*b*) times the value of income. Which is the value of saving itself out of income.

Note that, we have said earlier that, a constant amount of money '*a*' is always denoted for consumption, even if income is zero. this amount can be a borrowed amount or can be acquired by reducing or selling asset of the person. Borrowing or reduction of asset is an act of dis-saving or opposite to saving activity or negative saving. In any case when income Y = 0, then $C = a$. So $S = Y - C = 0 - a = - a$.

Hence the first part of saving equation is a negative of the constant *a*. The second part of saving equation is (1–*b*) Y. Here $b = MPC$. So $1 - b = MPS$. Hence $(1 - b)\,Y = MPS \times Y$. This implies that the value of saving out of income is calculate of as MPS times the value of income.

In the example given above, we gave that

$$C = 500 + 0.5\ Y$$

where a = 500

$$MPC = 0.5$$

So $$MPS = 1 - MPC = (1–0.5)$$

Now we can write the saving function

$$S = -500 + (1–0.5)\ Y$$

$$S = -500 + 0.5\ Y$$

Solving for *S*, We can easily find that *S* = 750 as calculated earlier.

Diagram of Saving Function

The saving function will start from the negative quotient from a value equal to '–a' on the vertical axis and then it will be upward stoping at a slope (or angle) equal to 1–*b* or *MPS*. See the diagram of saving function below.

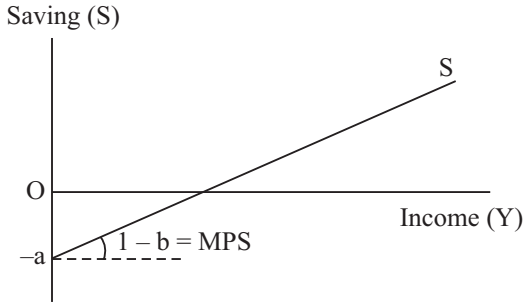


Fig. 26.3

In fig. 26.3 –*a*S is the saving function which starts from –a (below origin) and slope upward at a rate equal to 1–b or MPS. The distance '0 to –a' is the amount of fixed consumption or dissaving when income is zero.

Consumption, saving and Income

Now we can see how consumption and saving are determined for different values of income. We can also see the values of saving at the break even point. For this go back to table 1. and add the saving column. Table 1 was constructed on the basis of the consumption function equation $C = 500 + 0.5\ Y$.

Now add, saving function as S = – 500 + 0.5 Y. Construct Table 2, showing values

of consumption and saving for various level of income. Then check the remark column.

Table 26.2: Consumption, Saving and Income

Time	Y	C	S	Remark
1	0	500	– 500	C > Y, S < 0
2	500	750	– 250	C > Y, S < 0
3	1000	1000	0	C = Y, S = 0 (BE)
4	1500	1250	250	C < Y, S > 0
5	2000	1500	500	C < Y, S > 0

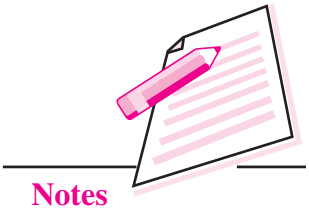
As given in the table 2 above, when Y = 0, *C* is equal to a positive constant 500 (i.e. a). So saving is – 500. When Y increase, *C* and *S* both increase. At Y = 1000, *C* = *Y* = 1000 which is called break even as already told. At the break even point, Saving is zero. After that, when *Y* further increases, *C* falls bellow Y as per psychological law of consumption. When *C* becomes less than Y, automatically saving becomes positive. For example at Y = 1500, C = 1250 So, S = 250 and at Y = 2000, C = 1500, S = 500 and so on.

INTEXT QUESTION 26.3

1. Name two factor influencing consumption behaviour in the economy?
2. If MPC = 0.8 and fixed consumption 'a' is 200, write the saving equation.
3. APC = 1– MPS. True of False
4. MPS = 1 – APS. True of False
5. MPC = 1 – MPS. True of False
6. Given income as 500 and consumption as 300, find out APC?
7. Change in income is 150.
   Saving changes from 200 to 280.
   Find out MPS.
8. At break even point , consumption equals zero. True or False.

26.5 INVESTMENT

Investment is a basic economic activity in the economy. This activity is carried out by the firms or producers in the economy. Investment is defined as addition to the



existing capital stock. Capital stock include fixed assets such as land, building, machinery and equipment etc and change in stock.

Investment by firms can be expressed in two ways:

(i) Gross investment and (ii) Net investment.

Gross investment is defined as sum of net investment and depreciation. Gross investment = net investment + Depreciation.

It should be mentioned that in order to produce goods and services in the economy for the purpose of consumption, producers or firms need to invest in machinery, equipment, land, building etc and stock of raw material and finished goods. Also due to normal wear and tear, these items loose their value over time period. Hence a producer must spend on depreciation charges against wear and fear of machinery.

The difference between gross and net investment is called depreciation. We can write

Gross investment – Net investment = Depreciation.

Nature of investment

In macro economics investment can be categorised as autonomous and induced.

Autonomous investment is that part of investment which is fixed and most needed to carry out production activity. It is independent of the level of income or value of output generated in the production process. Expenditure on land, building or machineries needed for production can be treated as constant or fixed as they are required to start production. It can be also treated in the same way as fixed consumption told earlier.

Symbolically autonomous investment can be written as

$$I = I_0$$

where I = investment

I_0 = Autonomous investment which is constant.

For example, let a firm wants to produce garments. For this the minimum requirement is a room and sewing machine. Whatever the level of output or income, expenditure on purchasing a room and sewing machine will be taken as autonomous investment. Say this amount is Rs. 20,000. Then autonomous investment is Rs 20,000.

The diagram for autonomous investment is given as a horizontal line as given below in Fig. 26.4.

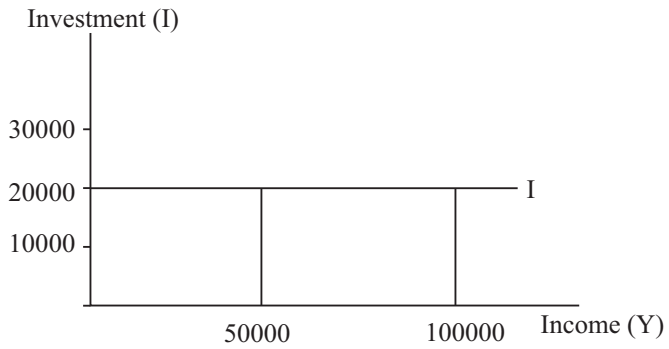


Fig. 26.4

Take investment on vertical axis and income on horizontal axis. In the diagram the autonomous investment line is horizontal at the value 20,000. This means that whatever be the level of income i.e. be it 0, or 50,000 or 100,000, investment will always remain 20,000.

On the otherhand induced investment is that part of investment by firms which is influenced by the level of income and profit motive. It may so happen that when income of firm increases, the firm gets encouragement to increase its business activity and accordingly invest more in capital stock. Hence it is called induced investment.

INTEX QUESTIONS 26.4

1. Autonomous investment is independent of the level of income. True or false
2. Induced investment in influenced by level of income. True of False.

WHAT HAVE YOU LEARNT

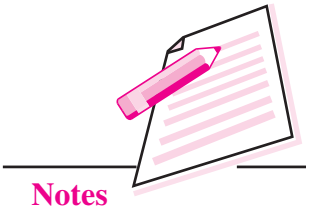
- Consumption function gives a direct reltionship between consumption and income.
- According to psychological law of consumption, Consumption increases at a comparatively slower rate than increase in income.
- Consumption function equation in the short run is given as

  $C = a + b$ Y

  where a = positive constant

  $b = MPC =$ and $b < 1$.

  Y = Income



- Saving function is given as

  $S = -a + (1-b)\ Y$

  where $1-b = MPS$.
- $APC + APS = 1$ and $MPC + MPS = 1$.
- Consumption and saving functions are upward stoping.
- At break even point consumption and income are equal while saving is zero.
- Rate of interest, wealth, distribution of income and consumer credit affect propersity to consume.
- Autonomous investment is independent of the level of income while induced investment depends on the level of income.
- Gross investment = Net investment + depreciation.

TERMINAL EXERCISE

1. Define consumption function. Relate it with saving function.
2. State and exlain psychological law of consumption?
3. Give the relationship between propensity to consume and save?
4. What are the factors that influence propensity to consume? Discuss.
5. What do you mean by break even point? Compare consumption and income before and after that point. Also compare level of saving before and after the break even point.
6. If $a = 60$, $MPC = 0.75$ then write down the consumption and saving equations. Find the value of consumption and saving when income is 200.
7. Distinguish between autonomous and induced investment?
8. Draw the diagram of consumption function and saving function and explain these diagrams?
9. Fill in the blanks in the table

Y	C	S	APC	MPC	APs	MPS
0		–50				
100				0.5		
200						

10. Distinguish between gross and net investment?

ANSWER TO INTEXT QUENTIONS

26.1

1. (b) 2. 400 3. (c) 4. $\frac{5}{7} = 0.71$ 5. $\frac{3}{10} = 0.33$

26.2

1. C = 100 + 0.75 y, 2. C = 210 3. MPC,
4. False, 5. C

26.3

1. Wealth and distribution of income

2. $5 = 200 + (1–0.8)y = 200 + 0.2y$

3. False,

4. False

5. True

6. $\frac{3}{5} = 0.6$

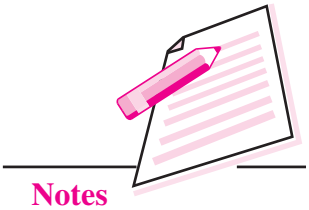
7. $\frac{8}{15} = 0.53$

8. False

26.4

1. True

2. True.



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THEORY OF INCOME DETERMINATION

Economy must produce goods and services and generate income for its citizens. For this it must provide employment opportunities. In this context it is important to ask the question "How much output should be produced in the economy?" What should be the level of income and employment?" John Maynard Keynes a famous economist who pioneered the study of macro economics in the 1930s has propounded a simple theory of income and employment to answer these questions.

OBJECTIVES

After completing this lesson, you will be able to:

- know the meaning of aggregate demand, aggregate supply and effective demand of an economy;
- tell the components of aggregate demand;
- determine the equilibrium level of income and employment;
- understand the concept and working of multiplier;
- distinguish between excess demand and deficient in demand; and
- expalin the methods to correct exces demand & deficient demand.

27.1 MODEL OF A SIMPLE ECONOMY

When We talk about the determination of income and employment in an economy the first step is to define the aggregate demand function of the economy. Here we assume that the economy is operating in the short run.

27.1.1 The Concept of Aggregate Demand

Aggregate demand of an economy is defined as the total demand for goods and services at the given price level.

Price are given or fixed because in a short run period prices of goods and services do not change.

A measure of aggregate demand is the aggregate expenditure incurred by the different consuming sectors of the economy on consumption of goods and services at the prevailing price level.Now the Questions arises –

Who are the consuming sectors in the economy? It must be noted that the economy's total product is used for final consumption as well as for further production. Accordingly, we can identify the following consuming sectors

1. Household
2. Firm
3. Government
4. Rest of the world

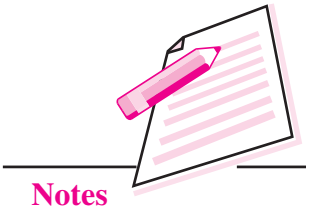
Aggregate demand consists of the demand for goods and services by theses sectors taken together.

Let us discuss these components of aggregate demand separately.

1. Household Consumption Demand

The household sector of the economy consists of individuals and families and non-profit organization who serve the households. These entities consume final goods and services for satisfaction of wants. Individuals and families demand both durable and non-durable goods. Examples of durable goods are, T.V., Refrigerator, Washing machine, Car, Scooter. Motorbike, Furniture, etc. Non-durable goods include food and non-food items. Cereals, pulses, vegetables, fruits etc. are food items whereas cloth, shoes, cosmetics , fuel. etc. are part of non-food items . All these goods are demanded by the households.

The non-profit organizations serving the household sector include charitable trusts, religious foundations etc., who demand goods and services to serve the household sector. They do not do business to earn profit. For example, a trust to serve the differently abled people demand various goods such as office stationeries, furniture. Vehicle etc. Such consumption is a part of household consumption demand.



2. Producers or Firm's Investment Demand

The firms and or the producers demand goods and services for further production. The demand for goods by the firms to produce a product is known as "Investment". Firms demand capital goods such as machinery and equipment. They also demand intermediate goods for further production. Purchase of wheat floor to produce bread by a bakery unit is an example of intermediate good or Secondary Inputs. Water, electricity, raw materials etc used for product in one examples of intermediate consumption.

3. Government Expenditure

The Government constitutes an important sector which purchases goods and services for the benefit of public. So, all purchases made by the government are intermediate purchases. The Government provides services such as law and order, defence, education and health etc. To provide these service, the government functions through various ministries and departments. To maintain these offices. The government purchases uniforms, vehicles, stationary, furniture etc. It spends money on payment of salaries to its employees. In this way, government expenditure constitutes a sizeable part of the aggregate demand.

4. Purchases by Rest of the World

We are living in the era of globalization where in countries are linked to each other through trade and transfers. A country which has got economic relation with another country is called an open economy. In an open economy, the foreign countries, which have economic relationship with the domestic country constitute the rest of the world. The way the households of the domestic country demand goods and services inside the country, in the same way the foreigners also purchase goods and services from the country from outside. This is called import of the rest of the world or export of the domestic country. However, since the households, firms and government of the domestic country also purchase goods and services from abroad which are called imports from rest of the world. Net export is calculated by deducting the imports of domestic country from abroad from its exports to rest of the world. Exports minus imports are called net exports . Net export is the measure of demand for goods and services by the rest of the world in the domestic Country.

Now we can write that aggregate demand is the sum of demands by households firms, and government and rest of the world. Let us express household demand as consumption, firms' demand as investment, government demand as government purchases and demand of rest of the world as net exports. Then, we can say that aggregate demand is the sum of consumption, investment, government purchases and net exports.

We can also write systematically :

$$AD = C + 1 + G + NX \quad ...(1)$$

Where, AD = aggregate demand

C = consumption

I = investment

G = Government purchases

NX = net exports

NX = X – M, Where X = Exports, M = Imports

AD is also called aggregate expenditure in the economy.

Determining equilibrium level of income

The first step in determining the equilibrium level of income in an economy is to estimate its aggregate demand. The aggregate demand in an open economy is given in equation above.

To develop a simple model, let us assume that there are two sectors in the economy - households and firms. The demands of other two sectors such as government and rest of the world can be assumed to be given for the time being.

In such a case. The aggregate demand will be the sum of consumption and investment. Symbolically in a two sector economy,

AD = C + I. where AD = Aggregate demand

27.2 CONDITION OF EQUILIBRIUM

The equilibrium income of the economy is determined at the point where aggregate demand equals the value of total output.

It can be said that actual value of total output is same as the economy's income. Let it be denoted as Y. It is also said that income is divided between consumption and saving.

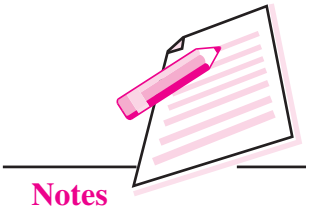
So, $Y = C + S.$

where S = Saving

So according to condition of equilibrium it can be written that:

$$AD = Y \quad ...(2)$$

Or, $$C + 1 = C + S \quad ...(3)$$



Or $I = S$ (4)

In an economy, the equilibrium level of income is determined at the point where aggregate demand equals total output and investment equals saving.

INTEXT QUESTIONS 27.1

1. Aggregate expenditure is a measure of aggregate demand . True / false.
2. What is the difference between exports and imports of an economy called ?
3. Whose demand is called final demand for goods and services.
   (a) Firms (b) Government
   (c) Households (d) Rest of the world
4. The condition for equilibrium income is given as
   (a) $C = S$ (b) $C + I = C + S$
   (c) $C + S = S + 1$ (d) $S = Y$

27.2.1 Diagramatic Representation

The equilibrium level of income can be presented using diagram. First, We have to make the diagram of aggregate demand which is the sum of consumption and investment in a two sector economy. You have already seen the diagram of consumption and investment functions in the previous lesson. We will use both these diagrams to construct the diagram of C + I as -given below.

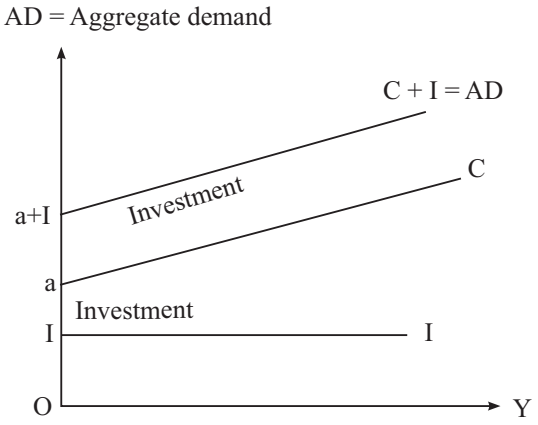


Fig. 27.1

In the previous lesson we said that the consumption function starts from point a on the vertical axis where Oa a is in the measure of fixed consumption. Then from

point 'a' the consumption function slopes upwards at a rate equal to MPC. It is also mentioned in the previous lesson that investment is fixed or autonomous . Hence, when we add investment with consumption function. then automatically fixed consumption and fixed investment will he added so that C + I will start from point a + I where 0 to a + I will be the measure of autonomous expenditure by both households and firms taken together.

Equation of C + I:

Note that, as said earlier, C = a + by

And, 1 is a fixed amount.

So, $C + I = a + bY + I$

$= (a + I) + bY$ ...(5)

Where b = MPC

It is seen clearly that when consumption function (C) starts from a, the aggregate demand (C + 1) starts from (a + I) which is above C by an amount equal to investment (I). Both C and C + I slope upwards at a rate equal to b or MPC. Hence C and C + I are parallel to each other.

27.2.2 The Significance of 45° line

The value of output is same as level of income Y. Also Y is the sum of C and S or Y = C + S. Geometrically on a 45 degree line through the origin Y = C + S when we measure income Y along horizontal axis and C + S along vertical axis. It should be noted that on a 45 degree line C + S = Y because it divides the plane into two equal parts, See diagram, below.

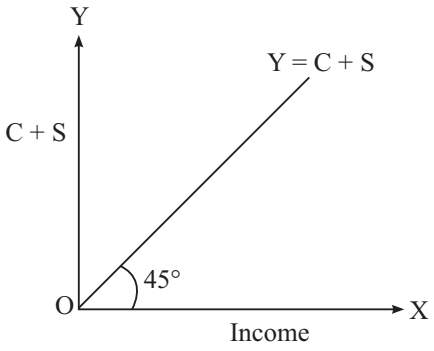


Fig. 27.2

27.2.3 Diagram for Equilibrium Income

To determine the equilibrium level of income , we can bring the above two diagrams of C + I and 45 degree line, together in one diagram as given below.

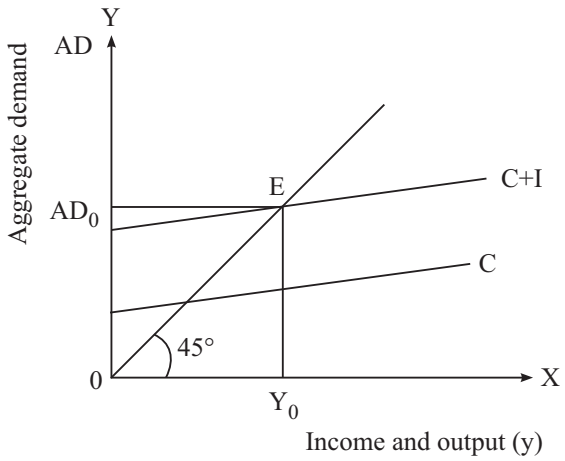


Fig. 27.3

As shown in the diagram above the aggregate demand line shown as C + I cuts the 45 degree line at point E. So E is the point of equilibrium where C + I = C + S. Drop perpendicular from point E on both the axis. The perpendicular cuts the horizontal axis which shows income an at point Yo. Hence the equilibrium level of income is determined at point Yo. OY_0 is the measure of equilibrium level of income. The level of aggregate demand that matches the measure of equilibrium income is determined at point. AD_0 on the vertical axis. The distance 0 to ADo (aggregate demand) equal the distance OYo (equilibrium level of income).

Equilibrium income by saving and investment approach

The equilibrium level of income can be determined by using saving and investment approach. Recall that, we have given the equilibrium condition as

$$C + I = C + S$$

This implies that I = S

Hence whenever aggregate demand equals total output, saving also equal investment. This means that the point at which saving and investment are equal refers to the equilibrium level of income. See diagram below

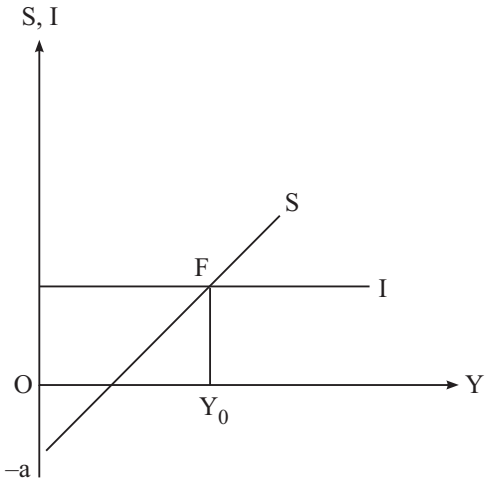


Fig. 27.4

In the Fig 27.4, income (Y) is measured along the horizontal axis. Saving and investment is measured along the vertical axis. The investment curve is shown as a horizontal line I indicating that investment is autonomous or fixed at all levels of income. The saving function is upward sloping starting from –a, below the origin, (see the lesson on consumption saving and investment). Both S and I curves cut each other at point F where S = I. From the point F drop a perpendicular on income axis (horizontal axis) to get the level of equilibrium income which is labelled as Y_0. Note that both the equilibrium level of income Y_0 shown in diagrams Fig. 27.3 and Fig. 27.4 are same.

It should be noted that in the economy people who save may be different from people who invest. So saving and investment equilibrium is not automatic or natural. It so happens that people plan to save certain amount but ends up in saving different amount. In other worlds planned saving may be different from actual or realised saving. The difference in planned and actual amount could be due to unexpected changes in prices in the market and changes expectations of households etc. Similarly, firms may plan to invest certain amount in assets but may end up in procuring asset which are different in value as planned earlier. This difference arises due to increase or decrease in price of assets (machinery and equipment) availability of loan from banks etc. So planned and realized investments may or may not always equal. Keynes has termed "planned" as "exante" and "realised" as "expost".

Accordingly we have exante saving and investment and export saving and investment. Below the level of equilibrium income i.e. Y_0, there is excess demand as I > S. Similarly above Y_0 there is excess supply situation as S > 1. Because of excess demand or excess supply in the economy price level, expectations of people fluctuate. So exante and expost items are not equal. At the equilibrium level of

income Y_0, there is neither excess demand nor excess supply. Hence exante and expost saving and investment are equal at equilibrium level of income.

27.2.4 Concept of Effective Demand

According to Keynes who gave the theory of equilibrium income, the point E in figure 27.3 is the point is the point of effective demand. In other words effective demand in the economy refers to the point where aggregate demand equals the level of output in the short run given the price level. This implies that the equilibrium level of income reflects the effective demand in the economy.

INTEXT QUESTIONS 27.2

1. What is the difference between aggregate demand and consumption is called .....?
2. The rate at which aggregate demand increases is known as .....?
3. Differentiate between aggregate demand (AD) and Effective demand (ED) ?

27.3 MULTIPLER AND ITS WORKING

Every economy wants to increase its level of equilibrium income every year . You know that increase in income is a manifestation of economic growth which is necessary to raise the standard of living of the population. To achieve this, the economy must increase the level of investment. Increase in investment is expected to bring about multiple increase in income. This means that increase in income has to be more than increase in investment In such a case, increase in income can be expressed as the product of some numerical value greater than one and the increase in investment. So take an example, Let investment in the economy increases from 100 crores to 150 crores, increase in investment is 150-100 = 50 crores. Let us expect that level of income increases by 100 crores. Since $100 = 2 \times 50$, it can be said that increase in income is equal to two times the increase in investment. Given the increase of investment the number which is multiplied with it is called multiplier. In this example multiplier is 2.

27.3.1 Definition of Multiplier

In the above example we can say that the multiplier 2 which is derived by dividing 100 crores by 50 crores. This mean $2 = \frac{100 \text{ crores}}{50 \text{ crores}}$

We can put this symbolically. Here 100 crores is the increase in income . Denote it as ΔY. Denote 50 crores, which is increase in investment, as ΔI. The multiplier 2 can be denoted as k . Then we can write that

Multiplier $k = \Delta Y / \Delta I$

Hence, multiplier is defined as the ratio of increase in Income to increase in investment. Using this equaiton we can also write that

$$\Delta Y = k\Delta I$$

This implies that increse in income is equal to multiplier times increase in investment. Here value of k holds key to increase in income given the value of increase in investment.

If $K = 1$. Then $\Delta Y = \Delta I$

This means that increase in investment brings about same amount of increase in income. If $k > I$ (k is greater than I) then, increase in investment will bring about higher increase in income than itself. We always expect that multiplier should be greater than 1, so that increase in income will be higher than that of investment which can be termed as profitable.

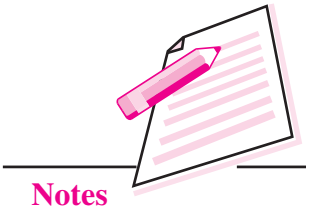
27.3.2 Derivation of the Value of Multiplier

In the above example if value of multiplier becomes 3 then increase in income will be 3×50 crores = 150 crores. If multiplier becomes 4, then increase in income will be still higher at 4×50 crores = 200 crores. Higher value of multiplier is always desirable. What determines the value of multiplier ? You know that firms make investments and give employment to produce goods and services and sell them in the market. They expect that consumers should demand their product so that they get higher return which will result in higher level of income. This implies that consumption demand is the important factor in influencing the level of income. As already said in the lesson on consumption, saving and investment, consumption demand is itself influenced by marginal prosperity to consume (MPC) out of income of the household consumers. So, higher the MPC, hither will be consumption demand for goods and services produced by firms who have made investment to produce them. Higher consumption will push the revenue or income of these firms upwards. So, multiplier which is multiplied by the increase in investment is determined by MPC. Higher value of MPC will make multiplier higher and vice versa. It is also said earlier that MPC is written as 1-MPS. If the value of MPS is small, then MPC is large. Hence, multiplier is higher if MPC is higher or MPS is lower. Similarly if MPC is lower or MPS is higher, then multiplier will be lower.

To derive the value of multiplier involving MPC or MPS we can use the condition for attaining the equilibrium income as follows:

$$C + I = C + S$$

Since, $C + S = Y$,



so $C + I = Y$

Multiply Δ through out to get

$$\Delta C + \Delta I = \Delta Y$$

Divide all through by ΔY to get

$$\frac{\Delta C}{\Delta Y} + \frac{\Delta I}{\Delta Y} = \frac{\Delta Y}{\Delta Y}$$

We know that $\frac{\Delta C}{\Delta Y} = MPC$

Then $MPC + \frac{\Delta I}{\Delta Y} = 1$

or $\frac{\Delta I}{\Delta Y} = 1 - MPC$

Reversing both sides we get

$$\frac{\Delta Y}{\Delta I} = \frac{1}{1 - MPC} = \frac{1}{MPS}$$

Since $\frac{\Delta Y}{\Delta I} = k$ or multiplier, we can write

$$\text{Multiplier } K = \frac{1}{1 - MPC} \text{ or } \frac{1}{MPS} \qquad (6)$$

Using the value of multiplier we can write that

$$\Delta Y = \frac{1}{1 - MPC} \times \Delta I \text{ or } \frac{1}{MPS} \times \Delta I$$

Example : If MPS is 0.2 and investment increases by ₹ 200 crores what is the increase in income ?

Answer: $\Delta Y = \frac{I}{MPS} \times \Delta I$

$$= \frac{1}{0.2} \times 200$$

$= 5 \times 200$

$= ₹\ 1000$ crores

So, increase in income is ₹ 1000 crores

Example: Given that MPC is 0.75 and investment increases from ₹ 100 crores to ₹ 150 crores. Find out value of multiplier and increase in income ?

Ans: $\text{multiplier} = \frac{1}{1-\text{MPC}}$

$= \frac{1}{1-0.75}$

$= \frac{1}{0.25} = 4$

Increase in income is given as

$\Delta Y = \frac{1}{1-\text{MPC}} \times \Delta I$

$= 4 \times (150 - 100)$

$= 4 \times 50$

$= ₹\ 200$ crores

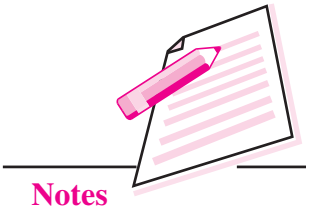
Example 3: Due to increase in investment from ₹200 crores to ₹ 280 crores, income increased from ₹1000 crores to ₹1240 crores. What is the value of multiplier ?

Ans : $\text{Multiplier} = \frac{\Delta Y}{\Delta I}$

$= \frac{1200-1000}{280-200}$

$= \frac{240}{80} = 3$

So value of multiplier = 3.



27.3.4 Working of Multiplier

It is found that given the value of MPC and increase in investment the increase in income can be determined. For example, if MPC = 0.5, ΔI = ₹100 crores then

$$\Delta Y = \frac{1}{1-0.5} \times 100 = 2 \times 100 = 200.$$

Here. we can ask a question, whether the increase in income is realized immediately or does it take place through various rounds? Infact we can show that the increase in income by ₹200 crores actually takes place through various rounds in the following manner:

Here, $\Delta Y = \frac{1}{1-0.5} \times 100$ crores

The multiplier. $\frac{1}{1-0.5}$ has the common ratio 0.5 which is less than 1. Using formula for geometric progression we can write that.

$$\frac{1}{1-0.5} = 1 + 0.5 + (0.5)^2 + 0.5^3 \ .....$$

Hence, $\frac{1}{1-0.5} \times 100$ crores can be written as

$$= (1 + 0.5 + (0.5)^2 + (0.5)^3 + ...) \times 100 \text{ crores}$$

$$= 100 + 0.5 \times 100 + (0.5)^2 \times 100\ 0.5^3 + ...$$

$$= 100 + 50 + 25 + ...$$

$$= 200$$

$$= \frac{1}{1-0.5} \times 100 = \text{Rs } 200 \text{ crores}$$

or $2 \times 100 = 200$

We can present the above sequence in a tabular manner.

Table : Working of Multiplier

Taking above example:

Rounds	ΔI	ΔY
1.	₹ 100 crores	₹ 100 crores
2.	...	₹ 50 crores
3.	...	₹ 25 crores

Explanation: When investment increases by ₹ 100 crores, aggregate demand (AD) increases by ₹ 100 crores since investment is a part of AD. But at the point of equilibrium AD = Y. So, income also increases by ₹ 100 crores in the first round i.e.

This also implies that $\Delta AD = \Delta Y$.

ΔY = 100 crore in the first round.

In the second round, consumption increases due to increase in income. Since MPC = 0.5 and ΔY = ₹ 100 crores

Increase in consumption or $\Delta C = MPC \times \Delta Y = 0.5 \times 100$ = ₹ 50 crores.

As a result of increase in consumption by ₹ 50 crores AD also increase by ₹ 50 crores as consumption is part of AD. But AD = Y at equilibrium, (so $\Delta AD = \Delta Y$, as said above). Hence in the second round increase in income is ₹ 50 crores. So after two rounds increase in income or ΔY = 100 + 50 = ₹ 150 crores.

In the third round, increase in consumption or $\Delta C = MPC \times \Delta Y$ of second round. So $\Delta C = 0.5 \times 50$. But $50 = 0.5 \times 100$. Hence $\Delta C = 0.5 \times (0.5 \times 100) = (0.5)^2 \times 100$ = ₹ 25 crores.

Increase in consumption again leads to increase in AD and finally increase in income by ₹ 25 crores in the third round. So, after three rounds, total increase in income = 100 + 50 + 25 = ₹ 175 crores.

This way increase in income takes place through initial increase in investment and latter by increases in consumption through various rounds till It equals

$$\frac{1}{1-MPC} \times \Delta I \quad \text{or} \quad k \times \Delta I$$

INTEXT QUESTIONS 27.3

1. If MPS = 0.5, what is multiplier ?
2. If MPC = 0.8, what is multiplier?
3. If increase in investment is ₹ 50 crores and income increases from ₹ 1000 crores to ₹ 1200 crores then find out multiplier?

4. If MPC is more then multiplier is less. True/false
5. If MPS is higher, then multiplier is lower True/false
6. Given that MPC = 0.8 and increase in investment is ₹ 100 crores find out increase in consumption in the second round ? What is total increase in income after two rounds?

27.4 EXCESS DEMAND

You learnt that equilibrium level of income is determined at the point where aggregate demand (AD) equals the level of output (Y). Let us assume that the level of output is at the maximum possible level or potential level which is achieved by full utilization of the resources of the economy. This means that the economy output will not increase beyond the potential level. You also learnt that increase in AD through increase in investment , brings about increase in income. or output due to working of multiplier. Now think of a situation in which the economy is already operating at its potential level of output and there is increase in investment at that level. What will happen? Will the level of output increase further?

The answer is that the economy's output will not increase. However due to increase in investment, which is a type of fixed or autonomous expenditure, the aggregate demand (AD) will increase and exceed the level of potential output. Such a situation is called excess demand in the country.

So. excess demand refers to the situation when aggregate demand exceeds the potential level of output in the economy.

The result of excess demand is inflation in the economy. The reason is obvious. When people have more money to demand more goods and services while the supply of output is less than this, then the price level will rise to balance the demand and supply forces.

Diagrammatically excess demand is created when AD line shifts upwards at the level of equilibrium as shown in the diagram below.

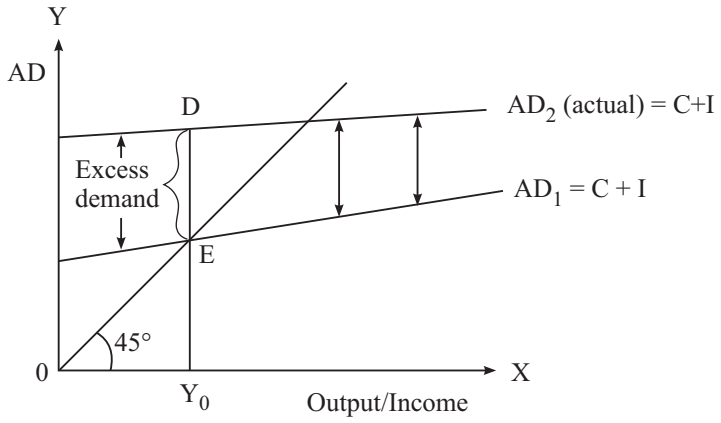


Fig. 27.5

In the diagram, it is shown that the equilibrium position is at point E, where aggregate demand line AD_1 meets 45 degree line. Let the economy be at equilibrium level of income. Now let aggregate demand increases from AD_1 to AD_2 due to increase in fixed investment or consumption. As a result a gap to the extent of DE is created which is the difference between the new and old aggregate demand. Here the income is not increasing beyond Y_0 after increase in AD. So the gap DE is the measure of excess demand in the economy. This gap is also called inflationary gap.

27.5 DEFICIENCY IN DEMAND

Deficiency in demand is exactly opposite to excess demand situation. When the economy is at its potential level and there is a fall in aggregate demand due to fall in autonomous consumption or investment, then it is called deficiency in demand. At this situation the output level seems to be in surplus in the market and people do not demand it thus putting pressure on price level to fall in order to balance the demand and supply forces. This creates deflationary pressure in the economy where deflation implies fall in prices of goods and services.

Diagrammatically, deficiency in demand is shown by the fall in AD line at the level of potential output as shown below in diagram.

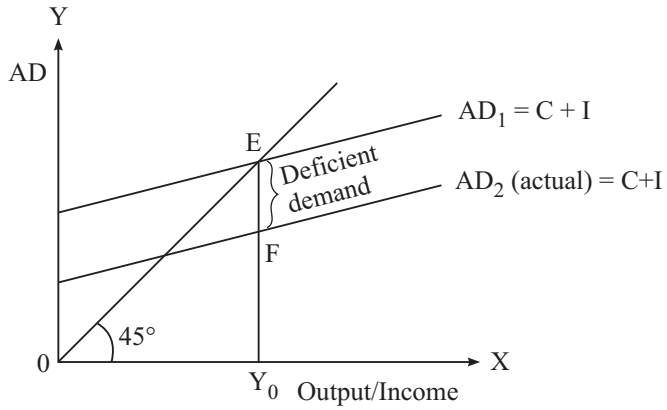
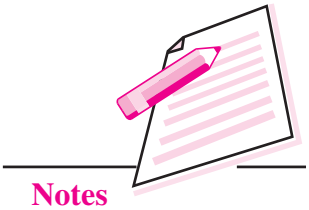


Fig. 27.6

In the diagram, equilibrium income is determined at point E where original aggregate demand, AD_1 cuts 45 degree line. The corresponding income at Yo is the potential level. Now at this level, AD_1 falls to AD_2 creating a gap EF without any fall in output. EF is the measure of deficiency in demand . This gap is also called deflationary gap.



Measures to correct excess and deficiency in demand:

Both inflation and deflation are bad for the society. Inflation reduces the purchasing power of the people so that they are not able to purchase the quantity they want causing reduction in their level of satisfaction. Poor and middle income group are worst affected by rise in the price level. Similarly, producers are worst affected by fall in prices or deflation. Their profit level falls due to fall in prices forcing them to reduce investment. This further causes employment level to fall. So the whole society gets badly affected by deflation.

Hence it is necessary to control inflation and deflation both. The measures or policies, implemented by the government to tackle these problems include:

(i) Fiscal policy

(ii) Monetary policy.

(i) Fiscal policy

Fiscal policy is the economic policy of the government that is concerned with (a) taxation (b) public expenditure and (c) public borrowing. The government uses fiscal policy to control the rising prices or deal with the situation of deflation. In case of inflation or excess demand situation the government can exempt the poor people from paying income tax and reduce the burden of tax on the middle class by increasing the limit of income level to be exempted from income tax.

At the same time government can increase the tax burden on the rich class who are capable of paying higher amount of tax. In case of tax on commodities, the government can tax the luxury items heavily, while reduce the taxes on necessary and normal goods extensively used by the population.

Along with taxation policy, the government must reduce public expenditure and public borrowing to control excess demand. Reduction in public expenditure and public borrowing reduces the supply of money thereby reducing inflation.

In case of deficiency in demand the government must increase its expenditure and borrowing to boost the economy. Public expenditure include expenditure on welfare of people, creation of infrastructure, investments to generate employment opportunities etc. For this government can borrow money to finance these schemes.

(ii) Monetary policy

The monetary policy is implemented by the country's centrol Bank. In case of India, it is the Reserve Bank (RBI) which implements monetary policy.

Monetary policy refers to credit control measures used by the central bank to regulate and control the level of credit creation by commercial banks. Too much

of credit supply by commercial banks crates excess demand in the economy while lack of credit facilities results in fall in money supply and deflation or deficiency in demand in the economy. Monetary policy aims at controlling the excess or deficiency in demand.

The following are the instruments of monetary policy.

(i) Bank rate

(ii) Open market operation

(iii) Variable reserve ratio

Bank rate is the rate at which the central bank discounts the securities of the commercial banks. It is also the rate at which commercial banks borrow money from the control bank. To check excess demand, the central bank increases the bank rate in order to control the borrowing capacity of the commercial banks so that they do not indulge in distribution of loans to the customers. As a result credit supply is checked. On the other hand, the central bank can decrease the bank rate to cure deflation.

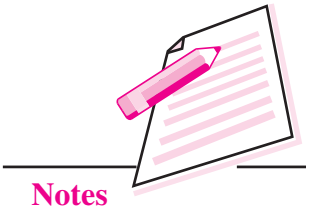
Open market operation refers to buying and selling of securities by central bank. Normally the commercial banks are the buyers of such securities.

During inflation (excess demand situation) the central bank sells government securities to commercial banks in returns of money. As a result money supply in the economy falls causing prices to fall. During deflation, the central bank will buy back the securities by paying money to the commercial banks thus causing money supply to rise which cures deficiency in demand.

Certain percentage of the value of the asset of the commercial bank is kept as reserves in the central bank called variable reserve ratio. To central excess demand, the central bank will increase the variable reserve ratio. So, that commercial banks have to a part with larger amount of their asset with the central bank. This will reduce their ability to supply more money in the society. To tackle deflation, the central bank will decrease the variable reserve ratio which will have the opposite effect.

(Also see monetary policy in lesson 28).

A major reason of excess demand in the economy is increase in credit supply by banks in anticipation of creation of more output in future Increase in credit or money supply creates immediate increase in demand for goods and services and thus rise in prices. Similarly fall in credit or money supply creates deficiency in demand as people do not have enough money to buy goods and services leading to fall in price.



INTEXT QUESTIONS 27.4

1. Excess demand creates inflationary pressure. True/false
2. Deficiency in demand leads to increase in price True/false
3. Increase in money supply creates excess demand . True/false
4. Decrease in credit supply leads to deflation True/false.
5. Tax policy is a part of monetary policy. True or false.
6. Public expenditure should be increased to cure deflation. True or false.
7. Reduce public borrowing to cure excess demand. True of false.
8. Bank rate must be increased to allow increase in money supply. True or false.
9. Open market operation is a fiscal policy instrument. True or false.

WHAT YOU HAVE LEARNT

- The components of aggregate demand are household consumption demand, investment by firms, government expenditure and net exports.
- The equilibrium level of income is determined at the point where aggregate demand equals total output in the economy. symbolically. $C + I = C + S$ in a two sector economy.
- The point at which $C + I = C + S$ is also called effective demand.
- Multiplier is defined as the ratio of increase in income to increase in investment.
- Multiplier= $1/1 - MPC = 1/MPS$
- Increase in income = multiplier × increase in investment

  Or $\Delta Y = 1/1 - MPC \times \Delta I$
- Multiplier process involves increase in income through various rounds due to initial increase in investment and subsequent increases in consumption.
- Excess demand refers to increase in aggregate demand at potential level of output.
- Excess demand creates inflationary pressure in the economy.
- Deficiency in demand refers to fall in aggregate demand at the level of potential output.
- Increase in money supply creates excess demand in the economy, excess demand is also called inflationary gap.

- Decrease in money supply creates deficiency in demand in the economy. Deficiency in demand is also called deflationary gap.
- Excess and deficiency in demand can be corrected by using fiscal and monetary policies.
- Fiscal policy is the policy of the government with respect to taxation, public expenditure and public borrowing
- Excess demand (deficiency in demand) can be corrected by decreasing (increasing) public expenditure and public borrowing.
- Monetary policy is the policy of the central bank to control credit creation of commercial banks. The instruments of monetary policy are bank rate, open market operation and variable reserve ratio.
- Excess demand (Deficiency in demand) can be corrected by increasing (decreasing) bank rate, selling (buying) securities in the open market and increasing (decreasing) variable reserve ratio.

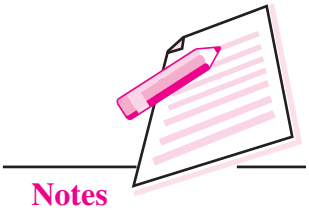
TERMINAL EXERCISE

1. Discuss the various components of aggregate demand in brief'?
2. Explain determination of equilibrium income in a two sector economy ? Give diagram.
3. Define multiplier and derive its value ?
4. Explain the working of multiplier through various rounds?
5. Define excess demand. Explain it by using suitable diagram?
6. Define deficiency in demand? Explain it by using suitable diagram?
7. What do you mean by effective demand? Use a suitable diagram to show it?
8. What are the components of fiscal policy?
9. How are they used to curb excess demand in the economy
10. What are the instruments of monetary polices? How are they used to cure excess demand in the economy
11. Explain the role of fiscal on monetary policies to check deficiency in demand?

ANSWERS TO INTEXT QUESTIONS

27.1

1. True
2. Net exports



3. Household
4. (b)

28.2

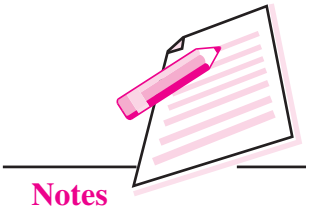
1. Investment
2. MPC
3. AD = C + I, ED in the point where C + I = C + S

27.3

1. 2
2. 5
3. 4
4. False
5. True
6. ₹ 80 crores, ₹ 180 crores

27.4

1. True
2. False
3. True
4. True



Notes

28

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MONEY AND BANKING

Money is one of the most important discoveries of the human civilization. It is difficult to think about the world without money. Everybody needs money for various purposes; starting from day – to – day transactions to saving for future. But if you go back to history, you will find that before money came into existence there was barter system to facilitate transactions among individuals in the society. With development of civilization over time, barter system lost its ground and was replaced by money.

OBJECTIVES

After completing this lesson, you will be able to:

- know the meaning and limitations of barter system;
- understand the need for money;
- define money;
- explain the functions of money;
- tell the different measures of money supply in India;
- know the concept of High Powered Money;
- explain the meaning and functions of commercial banks;
- understand the process of credit creation;
- explain the meaning and functions of central bank; and
- know the methods of credit control.

28.1 FAILURE OF BARTER SYSTEM AND THE NEED FOR MONEY

In ancient days when there was no money, people used to exchange goods for goods to satisfy their wants without the use of money. Such a system was called barter system. However with passage of time the barter system had to be abandoned because of its inherent problems. Some of the demerits of barter system are as follows:

1. Search Cost

A common problem of barter system was that, one had to spend a lot of time in searching for the person who is willing to exchange the good at the given terms and conditions. In the early period of human civilization, this was a very difficult task as there was no proper facility with regard to transport and communication.

2. Lack of double coincidence of wants

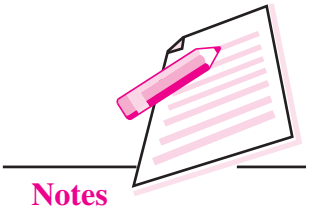
A common problem with the barter system is the lack of double coincidence ofwants which means that if one wants to exchange some good with another person then the latter must also be willing to exchange his/her good with the former. For example, let a person wants cloth and he has stock of wheat with him to exchange for it. In such a case the person can exchange wheat for cloth with another person who has cloth and who also wants wheat. In practical life, such situation may or may not arise. If the person who has cloth does not want wheat, then exchange of wheat for cloth will never take place and both the individuals cannot satisfy their wants. This is an example of lack of double coincidence of wants. So barter system will work when there is double coincident of wants, otherwise it will not work.

3. Lack of division of goods

Certain goods are not physically divisible into small pieces. Suppose, a person possesses a buffalo and he wants items, such as food grains. Then how much of buffalo can be traded for food grains? It was very difficult to determine because, a buffalo cannot be divided into several pieces.

4. Lack of common unit of measurement

Under barter system, it was difficult to equate the values of different goods which were traded because of lack of common unit of measurement.Taking the example in the previous paragraph, it will be verydifficult to determine the amount of buffalo required to trade for some specific amountof food grains. Also it sounds absurd. This happens because a buffalo can never become a common measure of value. This problem is same for all other goods.



5. Problem of Storage

Another problem of barter system is that a person must store a large volume of his own good in order to exchange for his/her desired goods with others on day to day basis. Take the example of a farmer who has produced wheat. Obviously, he will use some amount of wheat for his own consumption and keep some amount to get other necessary items by trading with others. If he wants furniture, then he will go to a carpenter who is willing to trade furniture in return of his wheat. Similarly, if he wants cloth, then he has to trade with a weaver who is ready to give cloth by receiving wheat and so on. So the farmer must construct a warehouse first to keep a stock of his wheat in order to carry out the transactions at the time of need for his desired good. But constructing and maintaining a warehouse was itself a very difficult task in early days of civilization.

6. Loss of Value

Finally, a major problem of barter system is that, a good looses its original quality and value if it is stored for a long period. Many goods, such as salt, vegetables etc., are perishable. Hence, goods were never accepted for trading in future because they could not be used as store of value. This also implies that no good could be used for the purpose of lending and borrowing.

Due to above problems, the barter system could not continue for long. As human civilization progressed, people realized that there has to be some common medium of exchange which can be easily carried, stored, and used to express the value of a good. So money came into being. Hence the need for money arose due to the failure of bartersystem.

INTEXT QUESTIONS 28.1

1. Under barter system a good was exchanged for coins. (True or False)
2. Simran wants to have 6 pencils in exchange of a note book from Kavita. But Kavita is not agreeing to this condition. The problem may be related to lack of double coincidence of wants. (True or False)
3. Ahmed took 10 kg of rice from Asghar last year as loan. Now he is willing to return the same. But Asghar is not accepting it. Give one possible reason for it.

28.2 MEANING OF MONEY

Money has been defined differently by different economists. But the most acceptable definition of money can be stated in terms of all the functions of money.

Money is anything which is generally accepted as a means of exchange, a measure and store of value and which also acts as standard of deferred payments.

28.3 FUNCTIONS OF MONEY

The use of money has removed the drawbacks of barter system. Broadly speaking the functions of money may be classified into *primary (basic)* and *secondary* functions.

Primary or Basic Functions:

(i) Medium of Exchange

Money acts as a medium of exchange of all goods and services. The use of money has greatly facilitated process of exchange by dividing it into two parts i.e. sale and purchase. It has removed the difficulty of double coincidence of wants found under the barter system. Therefore, in modern world we hardly find any evidence of exchange of goods and services without the use of money.

Example: You pay ₹ 10 to buy a pen. The seller receives ₹ 10 from you by selling the pen. So a pen is exchanged for ₹ 10.

(ii) Measure of Value

Money helps to measure value of goods and services in terms of price. The use of money has completely removed the confusion regarding value of one good/service vis-a-vis the other. This function has greatly facilitated the process of exchange of different goods and services. The value of a good is determined by multiplying its price with the quantity purchased. Since the price is expressed in monetary units, the value of a good is also expressed in monetary terms.

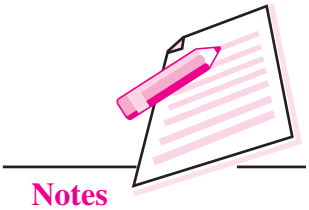
Example: Let price of rice be ₹ 20 per Kilogram. One bag full of rice weighs 25 Kilograms. Then the value of the bag of rice is ₹ 20X25= ₹ 500

Secondary Functions:

(i) Store of Value or Wealth

Money is the most convenient and economical means to store wealth which does not lose its value so quickly over time. Thus, it is the most accepted means to store wealth or value. As medium of exchange you can pay money to buy goods. This means if you have money, you have the power to purchase a good or a service. So money has purchasing power. The value of the good is contained in that purchasing power. Hence value of good is indirectly stored in money, you hold. Similarly, as a seller of good, you receive the money which means value of good you sold, comes back to you through money.

Example: Harpreet sells furniture to a buyer for ₹ 2500.This means a value of ₹ 2500 was exchanged. The buyer, who purchased the furniture, has the



purchasing power to give ₹ 2500 as value. Hence a value of₹ 2500 was stored in the money received by Harpreet as a seller. Harpreet could not have stored furniture but she can definitely store money which in turn has stored the value of ₹ 2500.

(ii) Standard of Deferred Payments

Deferred payments are those payments which are promised to be made in future. Money acts as a means of deferred payments mainly because it has general acceptability. Its value remains relatively constant over time and it is more durable as compared to other goods. In case of borrowing and lending activities only money is normally acceptable to be paid at a future date. Goods loose their value over time and due to possibility of lack of double coincident of wants they are not acceptable to settle debts in future.

(iii) Transfer of Value

This function of money is derived from the store of value function of money. Money is used to transfer value from one place to another or from one person to another. As a traveller when you move from one place to another, you can easily carry money to make necessary transactions on the way and in your destination place. You can also transfer the money through bank. Now people carry ATM card and withdraw cash wherever the facility is available.

Other functions of Money

(i) Distribution of National Income

Income is generated by the factors of production engaged in the production process. The factors are land, labour, capital and entrepreneurship. For the supply of these factor services to the production units, the supplier of labour gets wage, the supplier of land gets rent, the supplier of capital gets interest and the supplier of entrepreneurship gets profit. It should be noted that wage, rent, interest and profit are paid by the firms in money terms and received by the respective suppliers as factor incomes. Thus national income is measured by using income method.

(ii) Liquidity and Uniformity of Value

Money can be easily carried and is easily divisible into smaller units as per convenience. The liquidity feature of money is manifested at the time when it can be withdrawn from the bank account repeatedly in certain amount in each transaction. For example, your father has ₹10,000 deposited in his bank account. You want to purchase a shoe worth ₹600. Your father can withdraw the amount from the bank to give you. The balance of ₹9,400 will remain in your father's account.

Money brings uniformity in value of different goods and services which are not comparable physically due to their differences in the units of measurement.

For example a Kg. of rice and a liter of cooking oil cannot be added together as these are given in different units. But they can be added together if expressed in monetary units. If a Kg. of rice is worth ₹25 and a liter of cooking oil is worth ₹75, the combined value of rice and oil comes out to be ₹100.

28.4 MEASURES OF MONEY SUPPLY IN INDIA

Money supply refers to the total quantity of money held by public in various forms at any point of time in an economy. The main components of money supply are currency held by the public and net-demand deposits held by the commercial banks. The money supply in Indian economy is generally measured in following forms:

(i) M_1 = Currency (notes and coins) with the public + Demand deposits + other deposits held with the Reserve Bank of India.

(ii) M_2 = M_1 + Post Office saving deposits.

(iii) M_3 = M_1 + Time deposits of all commercial banks and co-operative banks (excluding interbank time deposits).

(iv) M_4 = M_3 + Total deposits with the Post Office Saving Organisation (excluding National Saving Certificate).

Of all the concepts of money supply stated above, M_1 is referred to as *narrow measure* and M_3 the *broader measure* of money supply. M_1 is the most important measure of money supply. M_1 is most liquid whereas M_4 is least liquid.

28.5 HIGH POWERED MONEY (H)

The HighPowered Money refers to the currency held by the public (C), cash reserves of banks (R) and other deposits of the R.B.I. High Powered Money is produced by the R.B.I. and the Government of India and held by the public and the banks.

INTEXT QUESTIONS 28.2

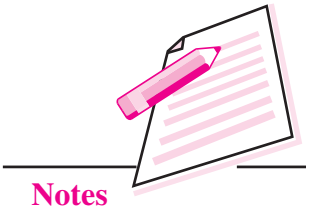
1. Which of the following statements are true and which are false?

   (i) M_1 is a narrow measure and M_3 is a broader measure of money supply.

   (ii) Currency notes and coins are not an important component of money supply.

   (iii) Supply of money is measured over a period of time.

   (iv) High powered money consists of cash with public, reserves with banks and other deposits with R.B.I.



(v) Government has no role in producing high powered money in an economy.

28.6 COMMERCIAL BANKS

Meaning: The commercial bank is a financial institution which is primarily concerned with accepting deposits from public and lending to the public besides others. These banks operate both under the public as well private sectors. Some public sector banks include the State Bank of India, Punjab National Bank and Bank of India among others. The private sector commercial banks may include the banks namely HDFC bank, ICICI bank and HSBC bank among others.

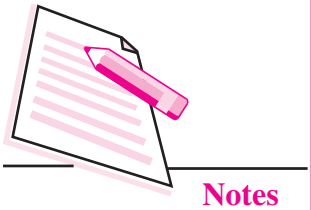
Functions of Commercial Banks: The commercial banks normally perform the following functions in an economy:

(i) **Acceptance of deposits:** Every commercial bank accepts deposits from different sections of society including the general public, business entities and other institutions. Commercial banks accept following types of deposit:

- **Current Account Deposits or Demand Deposits:** This type of account is generally maintained by the business entities and money under these deposits are payable on demand of the depositor. The depositors are free to deposit or withdraw money from their account any number of times without any restrictions.
- **Savings Account Deposits:** This type of account is generally maintained by the households or individuals. The depositor can deposit or withdraw money deposited under this account only for a limited number of times. This account also attracts a nominal rate of interest payable to the account holder.
- **Fixed Deposit or Time Deposit or Term Deposit:** Under this account money is deposited for a fixed period and the rate of interest is relatively higher than other accounts depending on the tenure of the fixed deposit.

(ii) **Extending Loans and Advances:** This is another important function of a commercial bank. This is also the main source of income of any commercial bank. Banks grant loans and advances out of the surplus money after keeping certain percentage of their total deposit called as reserves. Some important forms of loans and advances are *ordinary loans*, *overdraft facility* and *discounting of bills of exchange*.

(iii) **Creation of Credit:** This function is derived from the earlier two functions of the commercial banks. This unique function has direct impact on the supply of money in an economy.



(iv) **Transfer of Funds:** The banks provide the facility of fund transfer to its customers through the instruments of cheque, demand draft or electronic transfer from one place to another or one person to another.

(v) **Agency Functions:** Banks receive and collect different types of payments on behalf of their clients through the instruments of cheques, drafts, bills and promissory notes etc. Banks also buy and sell gold, silver and other securities on behalf of their customers.

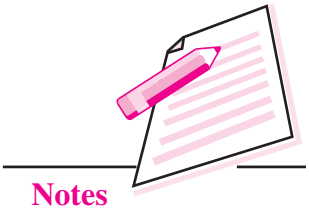
(vi) **Sale and Purchase of Foreign Exchange:** This is another important function of a commercial bank which has increased tremendously with increasing volume of international trade particularly in the era of globalization.

(vii) **General Utility Services:** In modern days the banks also perform some very useful functions for the benefit of its customers and the economy like collection and publication of data, advisory functions, issue of lockers and underwriting of loans, shares and debentures issued by the government.

28.7 CREATION OF CREDIT BY COMMERCIAL BANKS

Credit creation is one of the most important functions of a commercial bank. Banks create credit out of the deposits that is mobilized by them. Credit creation is also called money creation or deposit creation. Therefore, commercial banks are also known as creator of money or credit.

The process of credit/money creation: Money is not created by commercial banks by actually printing of notes or minting of coins. The money is created by granting loans and advances to public and making relevant entries into the books of accounts of the lending banks.Loans are granted out of the deposits received by the banks. Normally, the amount of loan granted by a bank is greater than the amount of deposits received by it. This is mainly because of the fact that when money is deposited by the depositors in a bank, the bank by its experience knows that not all the money would be withdrawn by the depositors at once at any point of time. This peculiar habit of the depositors leaves the bank with huge amount of surplus fund which in turn is used to create loans by the banks. The banks keep certain proportion of its total deposits in form of cash to honour the demand of its customers. Further, every commercial bank is required to keep certain proportion of its total deposits with the R.B.I. which is known as *Cash Reserve Ratio* (CRR). Besides CRR, the bank is also required statutorily to maintain certain proportion of its total deposits as liquid assets in form of cash, gold, and certain government approved securities. This is known as *Statutory Liquidity Ratio* (SLR). The CRR and SLR together form the *Legal Reserve Ratio* (LRR) which is determined by the central bank of a country (R.B.I. in case of India). When LRR is increased by the central bank the capacity of the commercial banks to create deposit or credit decreases and when LRR is decreased the capacity to create more credit increases.



Thus, there exists an inverse relationship between LRR and the quantity of money created in an economy. Given the quantity of deposits and LRR at any point of time, the total quantity of money created in an economy during a given period of time would be as follows:

Total quantity of money created: Quantity of deposits × 1/LRR. Let us understand the process of money or credit creation in an economy with the help of an example. Let us assume that the bank receives an initial deposit of ₹ 1000 and the LRR is 10%. It means the bank has an excess reserve of ₹ 1000 – (1000 x10%) = ₹ 900 to lend to the borrowers. It must be noted that the borrowers are not paid the amount of loan as cash but the same is credited in their account. Thus in the first round an extra deposit of ₹ 900 is created out of which the bank is free to advance loan worth ₹ 900 – (900 × 10%) = ₹ 810. In the second round an extra deposit of ₹ 810 is created and the total amount of money in the economy becomes ₹ 1000 + 900 + 810 = ₹ 2710. If the process continues the total amount of money created in the economy with ₹ 1000 would be ₹1000 × 1/10% = 1000 × 1/0.1 = ₹ 1000 × 10 = 10,000 (Ten Thousand). If the amount of LRR is 20% then the initial deposit of ₹ 1000 would create the total amount of money in the economy worth ₹ 1000 × 1/0.2 = ₹ 5000 (Five Thousand). **Thus, a higher LRR would create less amount of money and a lower LRR would create a higher amount of money in the economy.**

It should further be noted that only a fraction of total deposits is kept as cash reserves by banks because of two reasons. *First*, Banks by their experiences know that all depositors are not going to withdraw their money at the same time so the surplus money could be used to create loans and extra deposits. *Second*, there is a continuous flow of deposits in the banks, so banks are comfortable with their cash reserves.

INTEXT QUESTIONS 28.3

1. Which of the following statements are true and which are false?
   (i) Commercial banks are controlled and operated only by the public sector.
   (ii) Rate of interest on savings account deposits is less than fixed deposits.
   (iii) Functions of commercial banks are rising day by day in modern economy.
   (iv) Overdraft facility is an important form of granting loan to the public by banks.
   (v) Increase in legal reserve ratio reduces credit creating power of commercial banks.

28.8 CENTRAL BANK

Central Bank is an apex bank in an economy which is entrusted with the task to control, regulate and supervise the entire banking operations of all the commercial banks including formulation and implementation of monetary policy in the economy. The central bank of India is Reserve Bank of India (R.B.I.).

Functions of Central Bank

(i) **Bank of issuing or currency:** Every central bank of an economy is the sole authority to issue currency. The currency issued by the central bank is backed by minimum receive of assets like gold coins, gold bullions and foreign exchange etc. kept with the central bank. The Minimum Reserve System in India represent the minimum backing of Rs 200 crores by RBI out of which Rs 115 crores worth of gold and Rs 85 crores worth of foreign exchange securities are kept under RBI, the Monetary Authority of India. The authority of sole issue of currency has certain benefits like uniformity in currency, better monitoring and control over money supply and public trust and confidence in the currency issued and circulated.

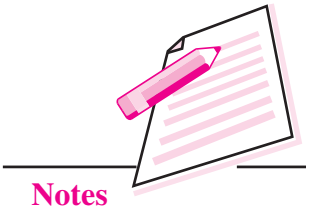
(ii) **Banker to the banks:** The central bank acts as a banker to the commercial banks in the following manner:

- Custodian of the cash reserves of the commercial banks (CRR).
- Lender of the last resort in the sense that if commercial banks fail to generate enough cash from its own sources it approaches the central bank as a last resort. The central bank in turn may grant loans and advances to the needy banks.
- The central bank also acts as central clearing house for the commercial banks.

(iii) **Banker to the government:** As a banker to the government the central bank carries out all banking businesses on behalf of both the central government and the state governments. It maintains current account of the government for keeping cash balances and also making and receiving payments on behalf of the government. It provides loans and advances to the government. It also acts as financial advisor to the government.

(iv) **Custodian of the stock of gold and foreign exchange reserves of the nation:** This function helps in maintaining stability in exchange rate as fixed by the government and also enforcing exchange control and other regulations for a favourable balance of payments for the economy.

(v) **Controller of credit and money supply:** Credit control and control of money supply is probably the most important function of a central bank. Through various methods/instruments of credit control the central bank aims



to achieve growth with stability in an economy. All the instruments of credit control may broadly be divided into following two categories. These are called instruments of monetary policy. Monetary policy is the policy of the central bank to control and regulate money supply and credit in the economy.

(A) Quantitative methods of credit control and

(B) Qualitative or selective methods of credit control.

The Quantitative methods include those instruments which affect the total volume of credit and affect all sections of the economy. It includes the following instruments:

(i) **Bank Rate Policy:** Bank rate is the rate at which central bank provides loan to the commercial banks. The increase in bank rate by the central bank increases the cost of funds to the commercial banks which in turn is passed on to their customers. High rate of interest reduces demand for loan and thus the quantity of credit/money in the economy which squeezes aggregate demand in the economy. Bank rate is increased to control inflation in an economy and it is reduced to fight deflationary situation in the economy.

(ii) **Open Market Operations:** Open market operations refer to the policy of sale and purchase of government securities in the open market by the central bank. The central bank sells and purchases these securities mainly to and from the public and commercial banks. If the central bank wants to control inflation it sells securities in the market so that the excess liquidity may be transferred from public to the central bank. This measure controls the aggregate demand and inflation in the economy. The central bank starts purchasing securities in the market to boost aggregate demand and fight deflation in the economy.

(iii) **Variable Legal Reserve Ratio:** The central bank can influence the credit creating power of commercial banks by varying CRR and SLR. Increase in LRR reduces credit creation capacity of commercial banks and decrease in LRR increases this power of the banks. LRR is increased during inflation and decreased during deflation.

The qualitative or selective credit control does not influence the quantity of credit/ money in totality but it is directed towards controlling credit in a particular use of credit. The qualitative methods of credit control are as follows:

(i) **Margin Requirements:** The commercial banks grant loan to borrowers against some collateral securities whose value is more than the the value of loans granted. The difference between the value of collateral securities and the amount of loan is called margin. Increase in margin requirement reduces loan eligibility of the borrower which central uses at the time of inflation. During deflationary situation margin requirement is reduced to promote the growth of volume of credit/money in the economy.

(ii) **Moral Suasion:** Under this method central bank persuades and pressurises the commercial banks to adopt a credit policy which is in line with the overall objectives of the economy.

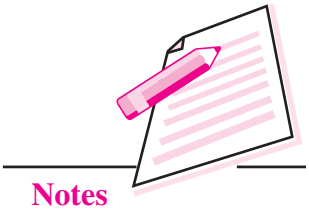
(iii) **Credit Rationing:** Under this method central bank fixes maximum ceiling of loans to be granted by the commercial banks either on aggregate basis or for a particular use. The rate of interest may vary across sectors or uses.

INTEXT QUESTIONS 28.4

1. Which of the following statements are true and which are false?
   (i) Central Bank is an apex bank in an economy.
   (ii) Central bank has little role in controlling and regulating the operations of commercial banks.
   (iii) Central bank acts as banker to the government.
   (iv) Central bank plays an important role in controlling and regulating money supply in an economy.
   (v) Quantitative methods of credit control influences the overall supply of money in an economy.
   (vi) Increase in bank rate reduces supply of money in an economy.
   (vii) During inflation the central bank increases bank rate and during deflation it reduces the bank rate.
   (viii) During inflation the central bank starts purchasing securities in the market.
   (ix) Selective credit control measures influence supply of money only in some sectors of the economy.
   (x) Credit rationing is an important form of selective credit control.

WHAT YOU HAVE LEARNT

- Barter system is a system of exchange under which goods are exchanged for goods without the use of money.
- Barter system suffered from many difficulties like lack of double coincidence of wants, lack of common measure of value, absence of standard of deferred or future payments and difficulty and wastage in the storage of wealth.
- Money is anything which is generally accepted as a means of exchange.
- Money also acts as measure and store of value and as standard of deferred payments.



- There are four measures of money supply viz. M_1, M_2, M_3 and M_4 of which M_1 is a narrow measure of money supply and M_3 is broader measure of money supply.
- The High Powered Money is the currency held by public (C), cash reserves of banks (R) and other deposits of the R.B.I .
- Commercial bank is a financial institution which is primarily concerned with accepting deposits from public and lending to the public.
- Functions of Commercial Banks mainly include acceptance of deposits, extending loans and advances, creation of credit and sale and purchase of foreign exchange:
- Higher LRR reduces commercial bank's power to create credit and vice-versa.
- Total quantity of money created: Quantity of deposits x 1/LRR.
- Central Bank is an apex bank in an economy which is entrusted with the task to control, regulate and supervise the entire banking operations of all the commercial banks.
- Important functions of central bank include credit control, issue of currency, banker to the bank, custodian of the cash reserves of the commercial banks, lender of the last resort.
- Central bank also acts as central clearing house for the commercial banks, banker to the government, custodian of the stock of gold and foreign exchange reserves of the nation, controller of credit and money supply.
- Central bank broadly uses two categories of instruments of credit control viz. quantitative methods and qualitative or selective methods of credit control.
- Quantitative methods include bank Rate Policy, open Market Operations and variable legal reserve ratio.
- Qualitative or selective credit control includes margin requirements, moral suasion and credit rationing.

TERMINAL EXERCISE

1. What is barter system of exchange?
2. What were the difficulties of barter system of exchange?
3. Define Money.
4. How money could solve difficulties related to barter system?
5. Explain different measures of money supply.
6. What is a commercial bank?
7. Explain important functions of commercial banks.
8. What are different types of deposits accepted by commercial banks?

9. What is credit creation?
10. Briefly explain the process of money creation or credit creation.
11. What is high powered money?
12. What is central bank?
13. What are the important functions of central bank?
14. Distinguish between quantitative and qualitative methods of credit control.

ANSWERS TO INTEXT QUESTIONS

28.1

(i) False (ii) True

(iii) Quality of rice may be lower/loss of interest.

28.2

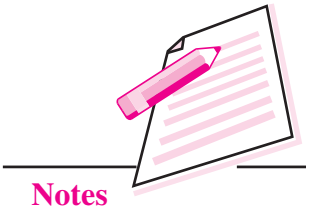
(i) True (ii) True (iii) False (iv) True (v) True

28.3

(i) False (ii) True (iii) True (iv) True (v) True

28.4

(i) True (ii) False (iii) True (iv) True (v) True
(vi) True (vii) True (viii) False (ix) True (x) True



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GOVERNMENT AND THE BUDGET

In India, government budget is normally presented in the Parliament in the month of February every year. Before the budget is presented, for many days there are speculations among people about the expected changes in various taxes. Are the rates of income tax going to be increased or decreased? Whether the price of petrol and cooking gas cylinders going to be left unchanged? All of us discuss these expected changes in budget because they affect our future expenditure on goods and services. However, this may give an impression that government budget is merely an exercise concerned with various taxes. But, in fact, government budget is much more than changes in taxes.

This lesson describes the structure of government budget and its objectives. In this lesson, you will learn about government budget and realize that it is more than mere changes in tax rates.

OBJECTIVES

After completing this lesson, you will be able to:

- understand the meaning of government budget;
- draw the structure of government budget;
- differentiate between revenue and capital receipts;
- differentiate between revenue and capital expenditure;
- differentiate between plan and non-plan expenditure;
- understand the meaning of revenue deficit, fiscal deficit and primary deficit;

- understand the ways to finance various deficits; and
- understand the meaning and objectives of budgetary policy.

29.1 WHAT IS GOVERNMENT BUDGET?

The budget of a government is a summary of the itemwise intended/expected revenues and anticipated expenditures of the government during a fiscal year/ financial year. In India the financial year spans from 1st April to 31st March over two calender years.

Government at all levels, whether central, state or a local level, prepare the budget. Budget is prepared, keeping in view the general policy of government towards the welfare of people.

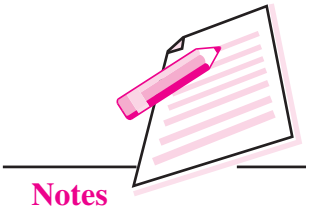
Government incurs various expenditures to provide basic facilities such as education, health, etc. It also spends money to increase production, to reduce unemployment, poverty and inequalities in income and wealth etc. Such expenditure of government promotes welfare of the people. To finance this expenditure, government raises revenue from sources such as taxes, public debt, etc. These financial resources that fund government expenditure are raised from people.

The items of expenditure and the sources of financing them are planned by government in accordance with the objective of public welfare. Thus, government takes decisions on behalf of people with respect to how public money is to be spent under different heads of expenditures and how it is to be raised from various sources. This makes government accountable to people. Through legislatures, parliament and various other civic bodies, people exercise their right to know as to how government is spending public money and how it is raising it from them. This accountability of government to the people of the country is manifested in the government budget. **A budget is a consolidated financial statement prepared by government on expected public expenditure and public revenue during a financial year.**

There are three main features of a government budget. **One,** it is a consolidated financial statement of expected expenditures and various sources of revenue of government. **Two**, it relates to a financial year. And **three,** the expenditures and the sources of revenue are planned in accordance with the declared policy objectives of government.

29.2 STRUCTURE OF BUDGET

To understand the basic structure of budget and its various components, let us consider the budget of the Central Government of India for the financial years 2012-13 presented in **Table 29.1.** From this Table we find that the budget has two parts:



(1) **Receipts and** (2) **Expenditures.**

Table 29.1 : Central Budget: Receipts and Expenditures of the Central Government (Rs. Crores)

		2012-2013 Actuals
1.	**Revenue Receipts**	**877613**
2.	Tax Revenue (net to centre)	740256
3.	Non-Tax Revenue	137357
4.	**Capital Receipts (5+6+7)**	**532754**
5.	Recoveries of Loans	16267
6.	Other Receipts	25890
7.	Borrowings and other liabilities	490597
8.	**Total Receipts (1+4)**	**1410367**
9.	**Non-Plan Expenditure**	**996742**
10.	On Revenue Account of which	914301
11.	Interest Payments	313169
12.	On Capital Account	82441
13.	**Plan Expenditure**	**413625**
14.	On Revenue Account	329208
15.	On Capital Account	84417
16.	**Total Expenditure (9+13)**	**1410367**
17.	Revenue Expenditure (10+14)	1243509
18.	Of Which, Grants for creation of Capital Assets	115513
19.	Capital Expenditure (12+15)	166858
20.	**Revenue Deficit (17-1)**	**365896**
		(3.6)
21.	**Effective Revenue**	**250383**
	Deficit (20-18)	(2.5
22.	**Fiscal Deficit**	**490597**
	(16-(1+5+6)}	(4.9)
23.	**Primary Deficit (22-11)**	**177428**
		(1.8)

(1) Receipts

The receipts of government show the different sources from which government raises revenue. These receipts are of **two** kinds: (i) **Revenue receipts** and (ii) **Capital receipts.**

Notes

Revenue receipts are current income receipts from all sources such as taxes, profits of public enterprises, grants, etc. Revenue receipts neither create any liability nor cause any reduction in the assets of the government. Capital receipts, on the other hand, are the receipts of the government which either create liability or cause any reduciton in the assets of the government. e.g. borrowings, recovery of loan and disinvestment etc.

It must be mentioned here that there is a similarity between the financing by an individual and the financing by a government. An individual, generally, finances his current expenditure from his current income. He borrows when his current income is not sufficient for his current expenditure. Likewise, a government has two sources to finance its expenditures: current income or revenue receipts and capital receipts. It borrows when revenue receipts fall short of its current expenditures. The dissimilarity between financing by an individual and that by a government is that an individual first estimates his current income and then plans his expenditures while a government plans its expenditures first and then finds the sources to finance them.

(1) Revenue Receipts

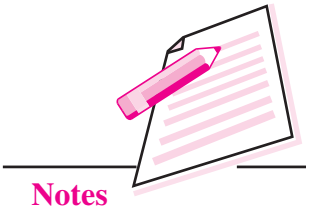
Revenue receipts are current incomes of government, which neither create liabilities nor cause any reduction in the assets of the government. These receipts are classified into (a) **Tax Revenue** and (b) **Non-tax Revenue.**

(a) Tax Revenue : A tax is a legal compulsory payment by the people and firms to the government of a country without reference to any direct benifit in return.. It is imposed on the people by the government. A government collects revenue from various taxes like income tax, sales tax, service tax, excise duty, custom duty etc. *Traditionally the revenue from taxes has been the primary source of government income.*

Income tax is imposed on those who earn income such as wages, salaries, rent, interest and profit. Sales tax is the tax on the sale of goods. Whenever we purchase a good, a part of our payment goes to the government as sales tax. Service tax is the tax we pay when we use a service such as telephone service. Excise duty is a tax paid by the producer manufacturing a good. Custom duty is paid when a good is imported or exported.

All taxes are of two kinds: (a) Direct taxes and (b) Indirect Taxes. This distinction between taxes depends on (1) the liability of payment of tax to government and (2) the actual burden of tax.

In case of *direct taxes,* the liability of payment and the burden of the tax falls on the same person. For example, income tax is a direct tax because the person who is liable to pay it also bears the burden of the tax; The burden of the tax cannot be shifted on others. But this does not happen in case of *indirect taxes.* For example,



in case of sales tax, although the liability to pay tax lies with the seller of a good, the actual burden of tax falls on the buyer. The buyer and not the seller is the one who finally pays the sales tax. The seller only collects the tax from the buyer by increasing the price and pays it to the government. Thus, we find that incase of sales tax, the burden of tax is shifted from the seller to the buyer. All taxes on production are indirect taxes because producers recover these taxes from buyers by increasing the price of the product.

Example of Direct Taxes

- Income tax: the tax on incomes of individuals
- Corporation tax : the tax on corporate profits
- Wealth tax: the tax on wealth of individuals
- Gift tax: the tax on gifts given

Example of Indirect Taxes

- Value added tax
- Excise duty: the tax on goods manufactured in factories
- Customs duty: the tax on imports and exports
- Service tax: the tax on the services provided

Difference between Direct Taxes and Indirect Taxes

S.No.	Basis	Direct taxes	Indirect taxes
1.	Impact	Direct taxes are levied on individuals and firms	Indirect taxes are levied on goods and services
2.	Shift of burden	The burden of a direct tax cannot be shifted, i.e. impact and incidence are on the same person	The burden of an indirect can be shifted, i.e. impact and incidence are on different persons e.g. a seller can increase the price of the good after tax is imposed so that the buyer will bear the burden of the tax.
3.	Nature	They are generally progressive in nature	They are generally proportionate in nature
4.	Coverage	They have limited reach as they do not reach all the sections of the society	They have a wide coverage as they affect all the sections of the society

(b) Non-Tax Revenue

The incomes accruing to government from sources other than taxes are *non-tax revenues.* The major sources of non-tax revenues of the central government of India are:

(i) Commercial Revenue: It is received by government in the form of prices paid by people for goods and services that government provides e.g. people pay for electricity and for services of Railways, postal stamps, toll etc.

(ii) Administrative Revenue: It arises on account of administrative services of the government. They are as follow:

(a) fees in the form of passport fees, government hospital fees, education fees, court fee, etc.

(b) fine and penalites: charged by government on law-breakers for disobeying rules and regulations.

(c) licence fee and permit

(d) Escheat : Income that government get by taking possession of property which has no legal claimant or legal heir.

(e) Interest receipts

(f) profits of public sector undertakings.

1. Capital Receipts

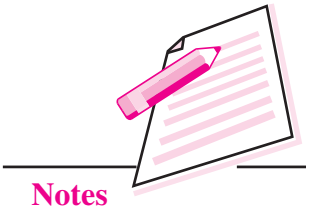
As stated earlier, capital receipts are those receipts of the government which either create liability or cause any reduction in the assets of the government.

The major sources of capital receipts of the central government are: (i) Borrowings (ii) Recovery of Loans and (iii) Disinvestment - Resale of shares of public sector undertakings.

(i) Borrowings: There are two sources from which the central government borrows. They are:

(a) Domestic Borrowings: The government borrows from domestic financial market by issuing securities and treasury bills. It also borrows from people through various deposit schemes such as Public Provident Fund, Small Savings Schemes, and National Savings Scheme etc. These are borrowings of the government within the country.

(b) External Borrowings: In addition to domestic borrowings the government also borrows from foreign governments and international bodies like International Monetary Fund (IMF), World Bank etc. Foreign borrowings by the government bring in foreign exchange into the domestic economy.



(ii) **Recovery of Loans:** Quite often state and local governments borrow from the central government. The loans recovered by the central government from state and local governments are capital receipts in the budget because recovery of loans reduces debtors (assets).

(iii) **Disinvestment - Resale of shares of public sector undertakings:** This is a very recent source of capital receipts by which the central government has been mobilizing financial resources since 1991. Prior to 1991, the central government owned 100 percent of the shares of public sector undertakings. From 1991, the government adopted the policy of privatisation of public sector undertakings. Consequently, it started selling its shares to general public and to financial institutions. This selling of shares of public sector undertakings by the government is known as **'disinvestment of public sector undertakings'.**

2. Expenditure

Government expenditure is classified in two ways: **capital expenditure and revenue expenditure** and (b) as **plan expenditure** and **non-plan expenditure.**

Capital Expenditure and Revenue Expenditure

When government incurs expenditure to create assets such as school and hospital buildings, roads bridges, canals, railway lines etc., or reduce its liability such as repayment of loan etc., such expenditure is known as **capital expenditure.** But when government incurs expenditure that neither creates any asset nor reduces any liability, such expenditure is known as **revenue expenditure.** For Example, payment of salaries to government employees, maintenance of public property, providing free education and health services to people, etc constitute revenue expenditure. These do not create any public asset.

Plan Expenditure and Non-Plan Expenditure

After independence, our country adopted the path of planning to achieve economic development. Under planning, provisions were made in the government budget for expenditure that was to be incurred every year according to the priorities laid down in the five-year plans. Such expenditure is known as **plan expenditure.**

Beside plan expenditure, government also incurs routine expenditure such as expenditure on police, judiciary, water supply, sanitation and health, legislatures, defence, various government departments, etc. Such routine expenditure is termed as **non-plan expenditure.**

INTEXT QUESTIONS 29.1

Choose the correct alternative.

1. Government budget is a financial statement of
   (a) Actural expenditure and actual receipts
   (b) Expected expenditure and expected receipts
   (c) Expected expenditure
   (d) Expected receipts
2. Capital Receipts are
   (a) Taxes
   (b) Dividends
   (c) Profits
   (d) Borrowings, recovery of loans, grants from foreign countries
3. Revenue receipts are
   (a) Borrowings
   (b) Revovery of loans
   (c) Grants from foreign countries
   (d) Taxes, interest, dividends and profits from public sector undertakings

29.3 BALANCED BUDGET VERSUS DEFICIT BUDGET OR SURPLUS BUDGET

As explained above, government receipt and expenditure are the two components of a budget. In terms of the magnitudes of receipts and expenditure. We may have balance budget, deficit budget and surplus budget.

- When the government expenditure is exactly equal to its receipts, the government has balanced budget.
- When the government expenditure exceeds its receipts, it is deficit budget.
- When the government revenue is greater than its expenditure, the government runs a budget surplus.

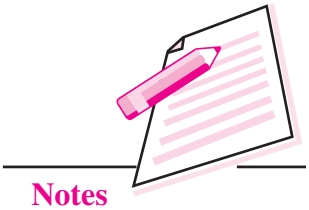
Thus:

Balance budget $\rightarrow$ Total Budgeted Receipt = Total Budgeted Expenditure

Dificit budget $\rightarrow$ Total Budgeted Receipts < Total Budgeted Expenditure

Surplus budget $\rightarrow$ Total Budgeted Receipts > Total Budgeted Expenditure

There was a time when budget surplus was regarded as an index of a good budget. However, in modern economy budget deficit has become order of the day.



29.4 TYPES OF BUDGET DEFICIT

1. **Revenue Deficit:** It refers to the excess of total revenue expenditure of the government over its total revenue receipts.

   Revenue deficit = Total Revenue expenditure – Total Revenue receipts.

   OR

   Revenue deficit = Total Revenue expenditure – (Tax Revenue + Non Tax Revenue)

2. **Fiscal Deficit:** Fiscal deficit is defined as excess of total expenditure over total receipts excluding borrowings during a fiscal year.

   Fiscal deficit = Total budget expenditure – Total budget receipts excluding borrowings

   OR

   Fiscal Deficit = (Revenue expenditure + Capital expenditure) – (Revenue Receipts + Capital receipts excluding borrowings)

   Fiscal deficit shows the borrowing requirements of the govt. during the budget year. Fiscal deficit reflects the borrowing requirements of the govt. for financing the expenditure including interest payments.

   Fiscal deficit = Revenue expenditure + capital expenditure – Revenue receipts – capital Receipts excluding borrowings

   OR

   Fiscal deficit = Revenue expenditure + capital expenditure – Tax Revenue – Non Tax Revenue – recovery of loans – disinvestment

   OR

   Fiscal deficit = Total borrowing requirement of the government

   Fiscal deficit indicates the additional amount of financial resources needed to meet government expenditure. Two, it is an indicator of the increase in future liabilities of the government on interest payment and loan repayment. The government has to pay back the borrowed amount with interest in future. Consequently, the government has to either borrow more from the people or tax people more in future to pay interest and loan amount.

3. **Primary Deficit:** Primary deficit is defined as fiscal deficit minus interest payments on previous borrowings.

   Primary deficit shows the borrowing requirements of the govt. for meeting expenditure excluding interest payment.

   Gross Primary deficit = Fiscal deficit – Interest payments

Notes

Net Primary deficit = Fiscal deficit + Interest received – Interest payments

It shows the total amount that the central government needs to borrow.

Three Ways to Finance Deficit

There are **three ways** by which the central government finances deficit. These are:

(a) Borrowing from Public and Foreign Governments

(b) Withdrawing Cash Balances held with the Reserve Bank of India (R.B.I.)

(c) Borrowing from the Reserve Bank of India (R.B.I)

The Government ordinarily prefers to borrow either from its citizens or from foreign governments instead of withdrawing cash balances held with the R.B.I. or borrowing from it. The later two ways to finance deficit increase the supply of money. The increase in supply of money increases the prices in an economy. On the other hand, borrowing domestically from public has no effect on the supply of money and consequently on prices because when government borrows, the money held by people is transferred to government with no change in the supply of money. However, the money supply would increase when government borrows from foreign countries. The last two ways to finance deficit increase the supply of money. Any money that flows out of the R.B.I. increases the supply of money in economy and increases the prices in domestic economy.

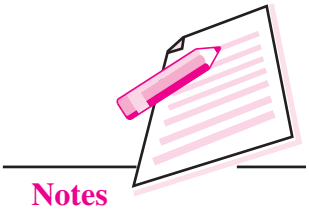
29.5 BUDGETARY POLICY (FISCAL POLICY)

Now you will know about budgetary policy. Budgetary policy relates to two important issues. These are:

1. The items on which the government should spend
2. How the government should raise resources to finance its expenditure?

The answer to the first question will depend on the priorities of the government to solve various economic, social and other problems that a country faces. For example, if there is a constant threat of attack from another country, the government has no choice but to spend more on defence. If there is a threat of outbreak and spread of an epidemic, the government has to spend more on health services. If the government had taken loan in the past, it has to spend more on interest payments.

On the second question the government has to consider various ways to raise resources. Should the people be taxed more? Which section of the people to be taxed more? Which commodities are to be taxed? How much the government should borrow? From whom should it borrow and in what form? The answers to these questions are to be found in the policy objectives of the government.



The fiscal policy is concerned with the raising of government revenue and increasing expenditure. To generate revenue and to increase expenditures, the government finance or policy called Budgeting policy or fiscal policy.

The major fiscal measures are:

1. **Public Expenditure** – Government spends money on a wide variety of things, from the military and police to services like education and health care, as well as transfer payments such as welfare benefits.
2. **Taxation** – Government imposes new taxes and change the rate of current taxes. The expenditure of government is funded by the imposition of taxes.
3. **Public Borrowing** – Government also raises money from the population or from abroad through bonds, NSC, Kisan Vikas Patra, etc.
4. **Other Measure** – Other measures adopted by the government are:
   (a) Rationing and price control
   (b) Regulation of wages
   (c) Increase the production of goods and services.

Objectives of Budget and Budgetary Policy

1. **To promote economic growth:** Government promotes economic growth by setting up basic and heavy industries like steel, chemical, fertilizers, machine tools, etc. It also builds infrastructure like roads, canals, railways, airports, education and health services, water and electricity supply, telecommunications, etc. that foster economic growth.

   Both basic and heavy industries and infrastructure require huge amount of investment which normally the private sector does not take up. Since these industries and infrastructure facilities are essential for economic growth in the country, the burden to set up and develop them falls on the government.
2. **To reduce income and wealth inequalities:** Government reduces inequalities in income and wealth by taxing the rich more and spending more on the poor. Further, it provides for the employment opportunities to poor that help them to earn.
3. **To provide employment opportunities:** Employment opportunities are increased by the government in various ways, One, jobs are created when it sets up public sector enterprises. Two, it provides subsidies and other incentives like tax holidays, low rates of taxes etc. to private sector that encourage production and employment. It also encourages setting up of small scale, cottage and village industries by people which are employment oriented. This it does by providing them tax concessions, subsidies, grants, loans at low rates of interest, etc. Finally, it creates jobs for poor when it undertakes public works programmes like construction of roads, bridges, canals, buildings, etc.

4. **To ensure stability in prices:** Government ensures stability of prices of essential goods and services by regulating their supplies. Hence, it incurs expenditure on ration and fair price shops that keep sufficient stock of food grains. If also subsidizes cooking gas, electricity, water and essential services like transport and maintains their prices at low level affordable to the common man.

5. **To correct balance of payments deficit:** The balance of payments account of a country records its receipts and payment with foreign countries. When payments to foreigners are more than receipts from foreigners, the balance of payments account is said to be in deficit. Quite often this deficit is caused when a country imports more than it exports. Consequently, the payments on imports to foreigners are more than the receipts from exports. In such a situation, to reduce the deficit in balance of payment account, the government discourages imports by increasing taxes on them and encourages exports by increasing subsidies and other export incentives. However, it should be noted that tax on import is not a popular measure now as it is treated as an obstacle to free flow of goods and services between countries.

6. **To provide for effective administration:** Government incurs expenditures on police, defence, legislatures, judiciary, etc. to provide effective administration.

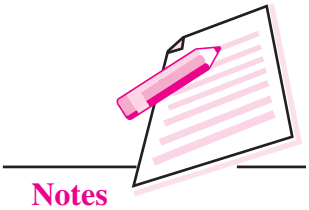
INTEXT QUESTIONS 29.2

Fill in the blanks with appropriate word(s) within the brackets.

1. Government budget is in deficit when total budgeted expenditure is ..... total budgeted revenue. (less than, greater than, equal to)
2. Fiscal deficit ..... government borrowings. (includes, excludes)
3. Budgetary deficit is ..... measure of deficit compared to fiscal deficit. (a better, not a better)
4. Money supply ..... when government borrows from the Reserve Bank of India. (decreases, increases)

WHAT YOU HAVE LEARNT

- Government budget is a consolidated financial statement relating to a financial year of expected item wise expenditures and expected revenue of government for fiscal year.
- The receipts in a government budget are of two types: (1) Revenue receipts and (2) Capital receipts.
- The sale of its own shares in public sector undertakings by government is known as 'disinvestment of public sector undertakings'.



- Government expenditure is classified as (1) Revenue and Capital expenditure and as (b) Plan and Non-Plan expenditure.
- Budget deficit is the excess of total budgeted expenditure over total budgeted receipts *net of borrowings*. It indicates the total borrowing requirement of government.
- Three ways by which the central government finances deficit:
  - (i) Borrowings from public and from foreign governments.
  - (ii) Withdrawing cash balances held with the Reserve Bank of India.
  - (iii) Borrowings from the Reserve Bank of India.
- The selection of items of expenditure and sources of financing them in tune with policies and programmes of the government, is termed as the budgetary policy of government.
- The main objectives of budget and budgetary policy are:
  - (i) to promote economic growth,
  - (ii) to reduce income and wealth inequalities,
  - (iii) to provide employment opportunities,
  - (iv) to ensure stability in prices,
  - (v) to correct balance of payments deficit and
  - (vi) to provide for effective administration.

TERMINAL EXERCISE

1. What is a government budget? What do you understand by the term 'financial year'?
2. Outline the structure of government budget and briefly explain its various constituents.
3. Distinguish between revenue receipts and capital receipts.
4. Distinguish between revenue expenditure and capital expenditure.
5. Distinguish between plan and non-plan expenditure.
6. Distinguish between surplus budget and deficit budget. How do they limit the economic activity?
7. State the difference between fiscal deficit and budgetary deficit.
8. Why fiscal deficit is a better measure of deficit as compared to budgetary deficit?
9. What are the different ways to finance deficit in government budget? Explain them.

10. State the effects of government borrowing from public and from Reserve Bank of India. Which one is better and why?
11. State and explain the objectives of budgetary policy.
12. Explain the need of government budget.

ANSWERS TO INTEXT QUESTIONS

29.1

1. (b) 2. (d) 3. (d)

29.2

1. (greater than) 2. (excludes) 3.(not a better) 4. (increases).